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SETTING THE STANDARD

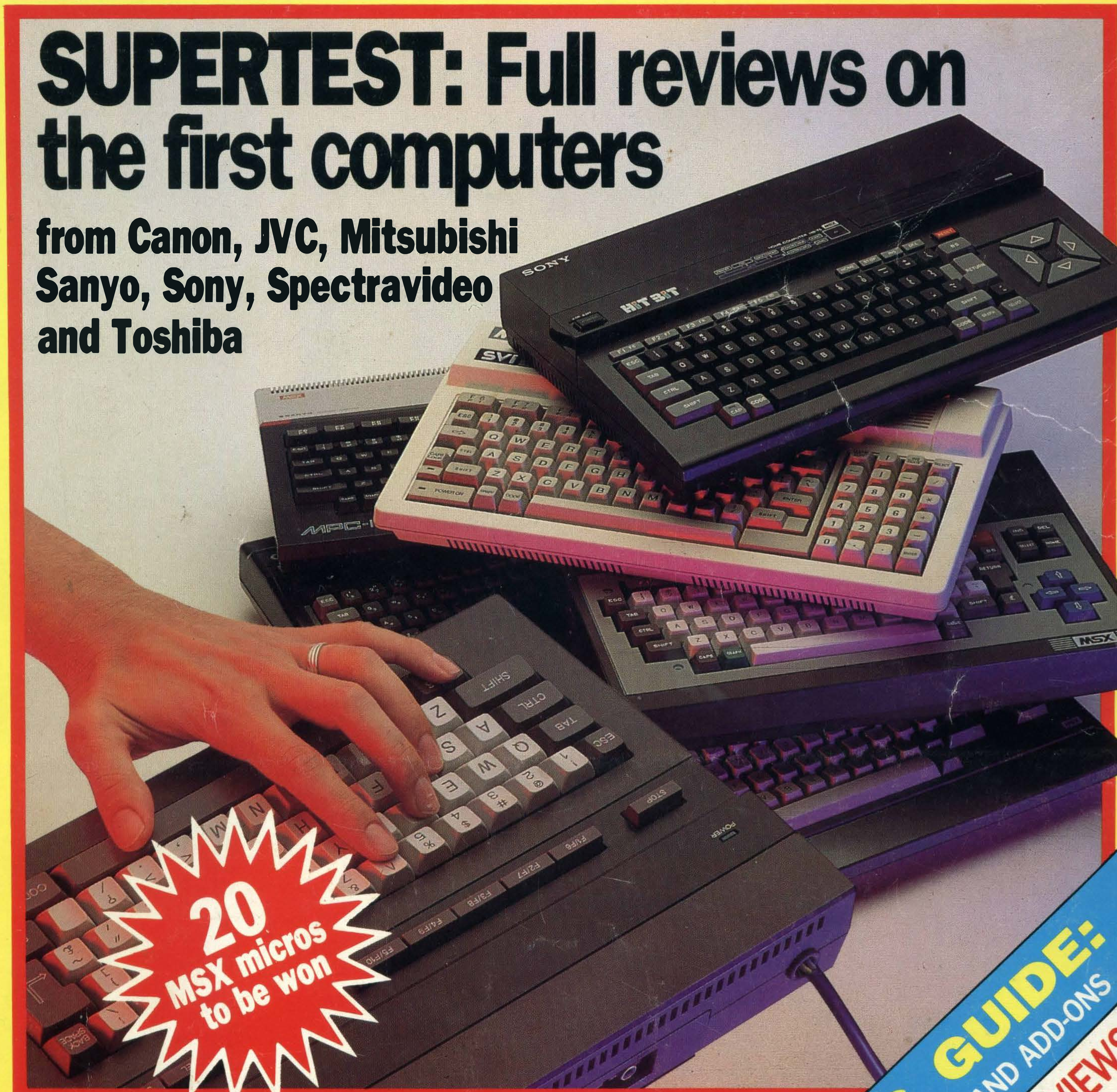
What MSX?

November/December 1984

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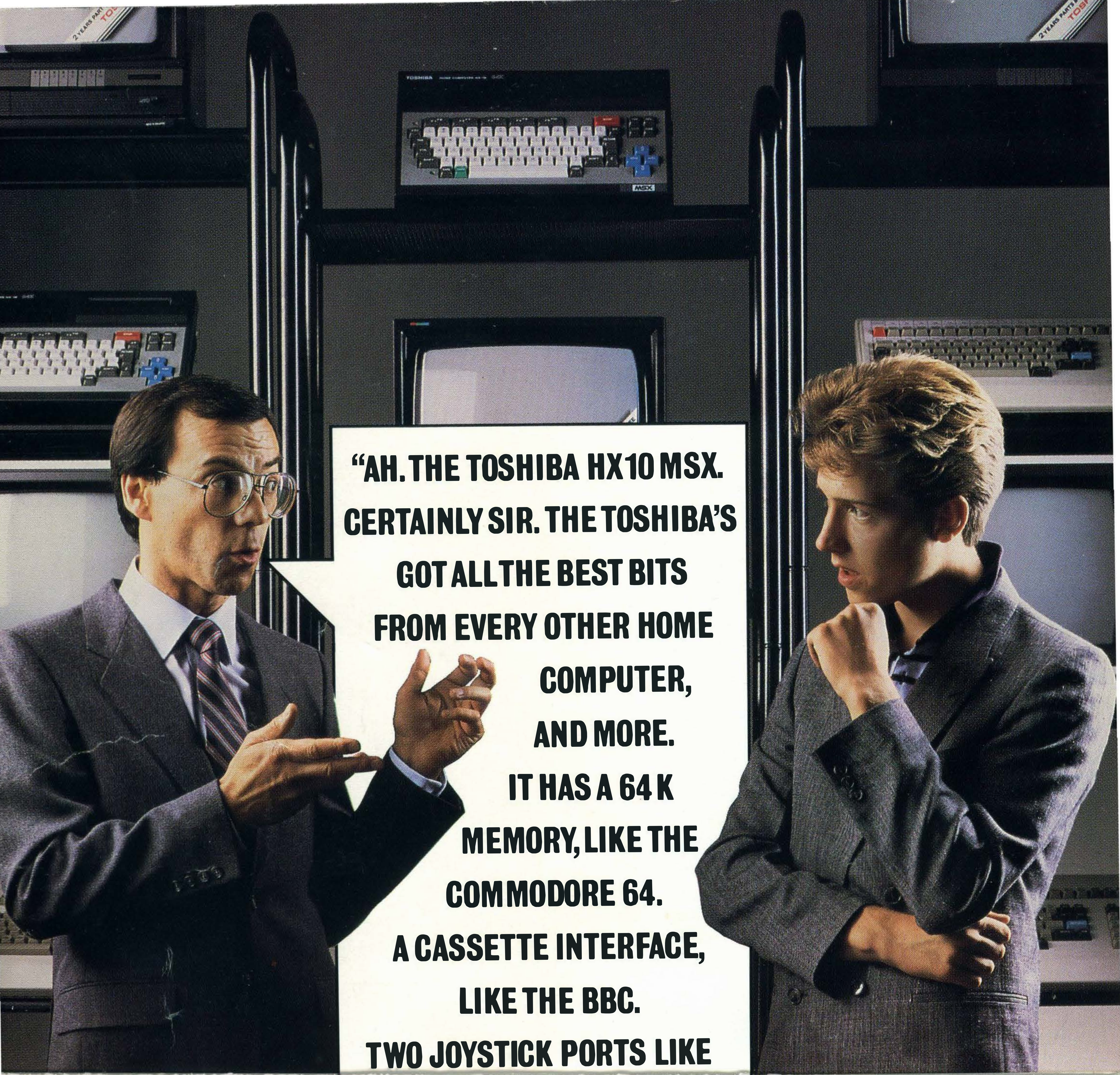
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TOSHIBA MSX

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What MSX?

November/December 1984 **Volume 1 Number 1**

NEWS



Modem—your key to unlock the MSX Net

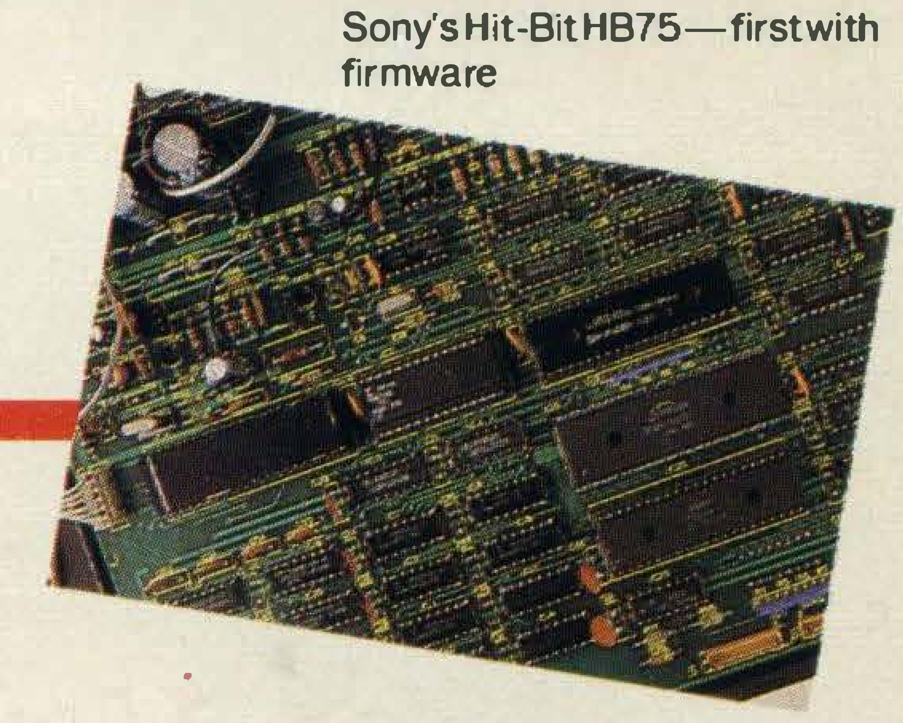
COMPETITION



ON TRIAL



Sony's Hit-Bit HB75—first with firmware



BACKGROUND



SOFTWARE



MARKETS



BUYERS GUIDE

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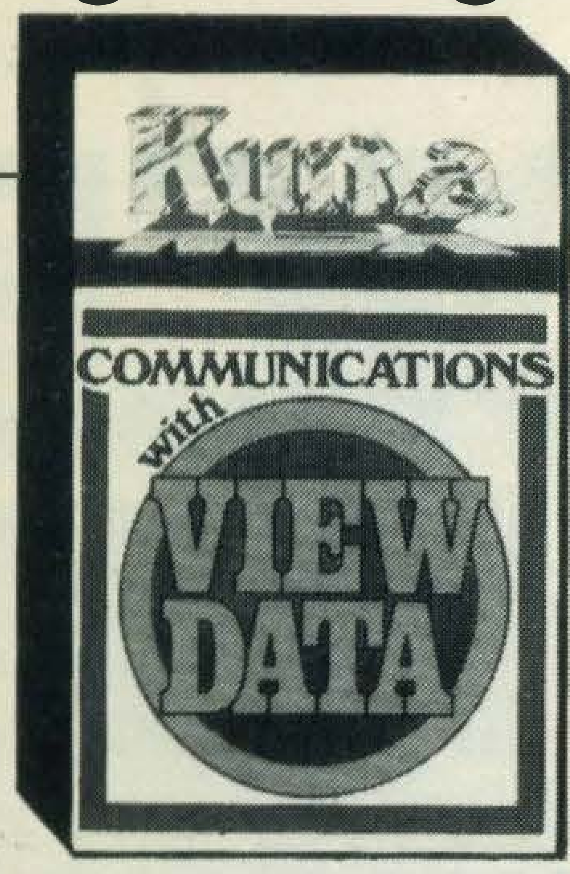
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US games giant converts chart topping Decathlon for MSX micros



KUMA COMM. PACKAGE

Kuma Computers have added a communications package to their already substantial range of MSX software. MSX Viewdata used with a modem and RS-232 interface will allow users to tap into Electronic Mail services such as Prestel and Telecomm Gold.

The package also supports software down-loading and off-line text preparation. Possible applications include Electronic Mail and Telex. Priced at £19.95, MSX Viewdata is available from: *Kuma Computers on 07537 4335.*

ACTIVISION FAVOURITES OUT ON MSX

Activision, a well known name in the video game cartridge field, are all set to muscle in on MSX territory. They have no less than five cassette-based games lined up for the launch this winter.

The first three will go out in mid-September, priced at £11.99 each. They are River Raid, Beamrider and Decathalon, all reviewed in this issue.

River Raid is an all action shootout. Your fighter must negotiate a twisty river, blasting enemy tanks, bridges, boats, fuel dumps and so on. Beamrider is set on a grid, with you at the controls of a spaceship. Destroying waves of aliens is the name of the game. Up to four players can take part.

Decathalon is a simulation of the ten event competition. Skill and stamina are needed to master the diverse disciplines. There is also a practice mode included besides the actual competition.

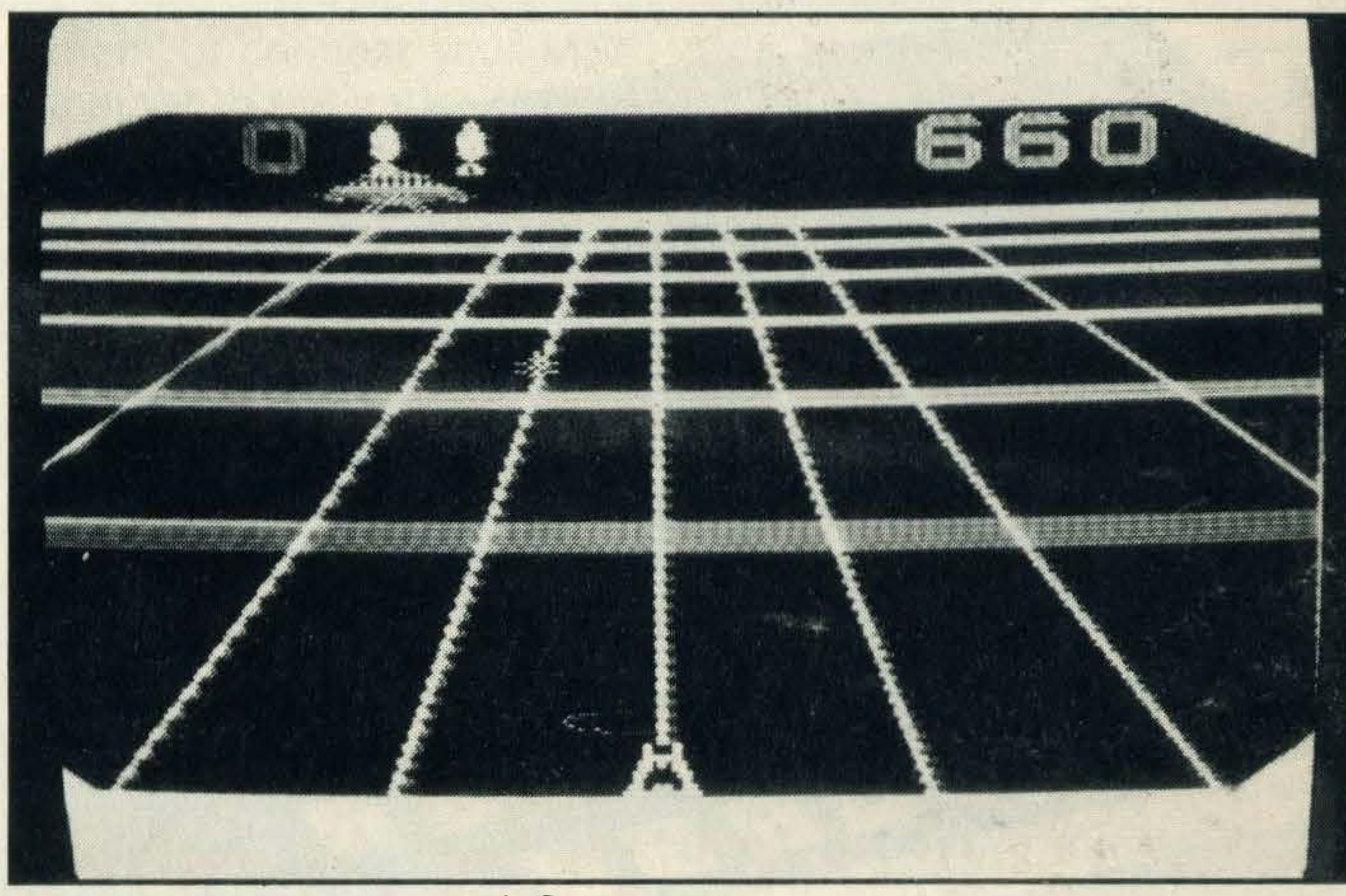
The games are scheduled for release at a later date.

Pitfall II is an arcade adventure with colourful graphics. Pitfall Harry is searching for treasure and lost companions in a network of underground caverns, tunnels and rivers.

Space Shuttle is a flight simulator in which you have to fly a mission in the NASA space shuttle. There is a wide range of controls to get to grips with.

Finally, on a different note, there is Zenji. This is a game with a mystical flavour. The object is to connect up larger and larger mazes. The designers claim that intuition is more important than having fast reflexes.

To learn more, contact: Activision, 15 Harley House, Marylebone Rd, London NW1



A screen shot of Activision's Beamrider

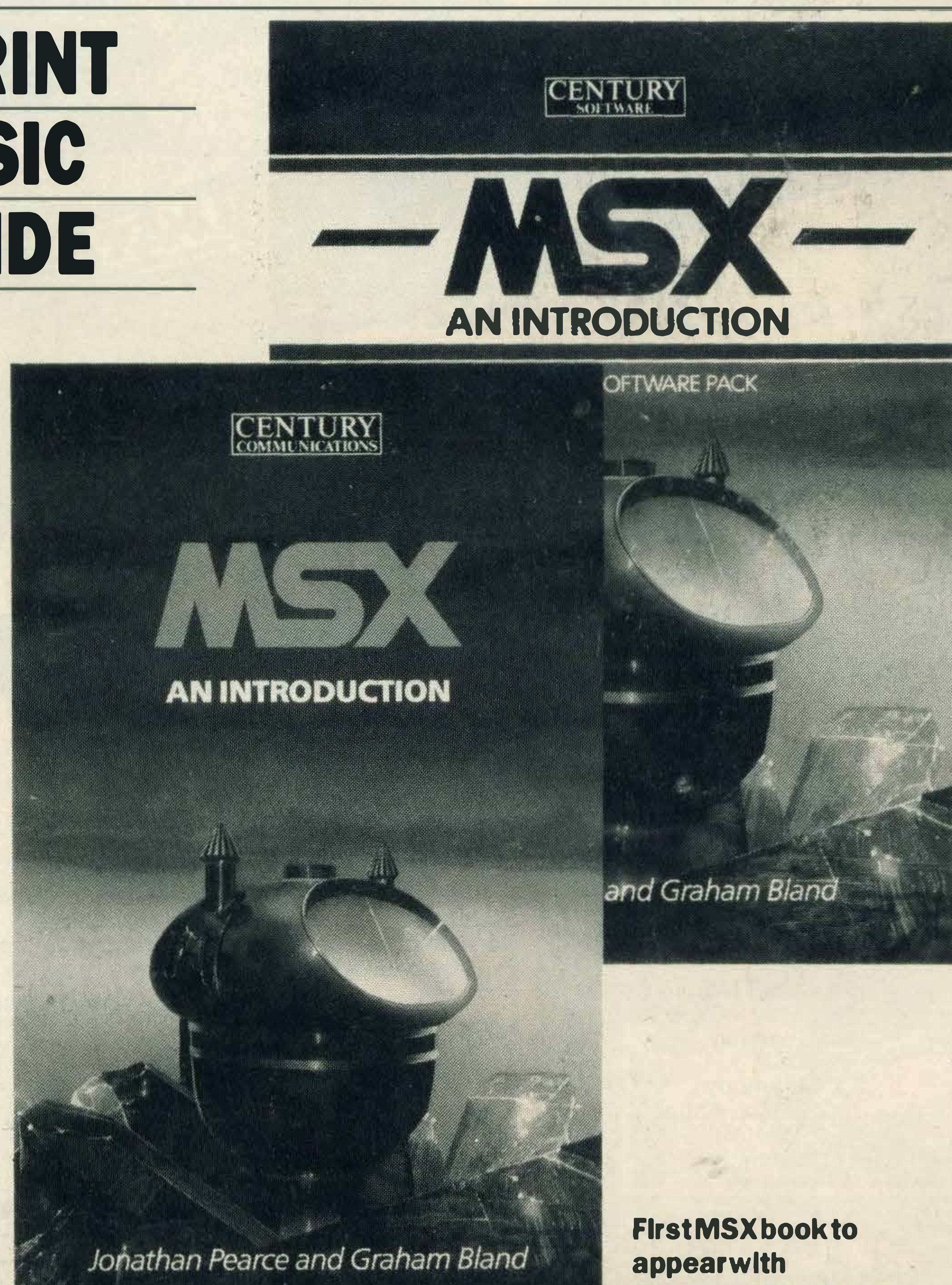
FIRST INTO PRINT WITH MSX BASIC PROGRAM GUIDE

There will no doubt be a flood of MSX related books in the next few months. First past the post is MSX: An Introduction, by Jonathan Pearce and Graham Bland. Published on August 23rd by Century Communications, it is available in the shops now for £7.95.

Written as a beginner's guide to MSX, the book examines the history of the concept and BASIC programming skills. Many programs, some of considerable length, are used to make points.

For those unwilling to type in the programs, a separate cassette is available for £6. Alternatively, the book and cassette are being sold as a package for £11.95.

Details on both products are available from: Century Communications, Portland House, 12-13 Greek St, London W1V 5LE.

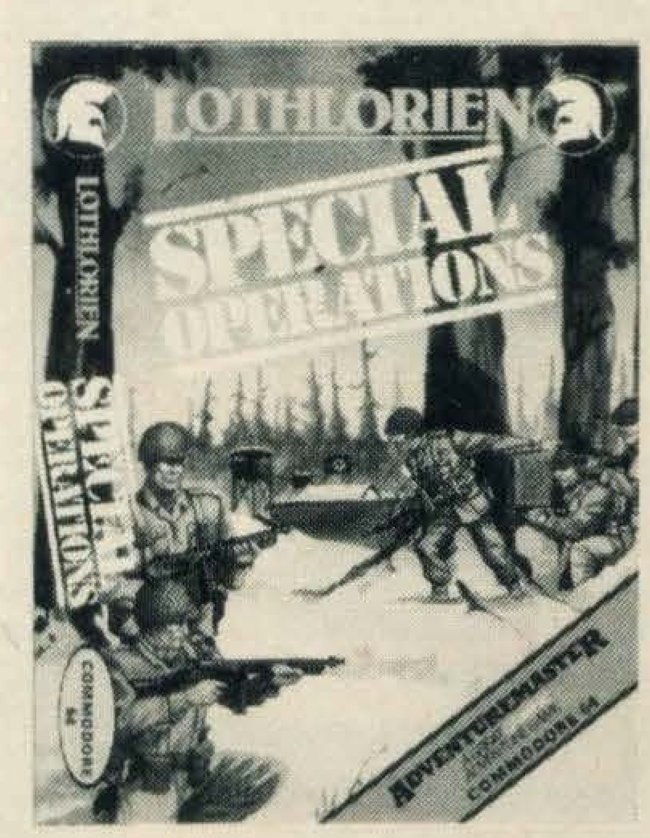


First MSX book to appear with supporting software

COMMANDO ADVENTURE

MC Lothlorien, well known for their Spectrum and Commodore games, are launching their first MSX title soon. It is called *Special Operations*, and converted from other machines.

It is described as a graphics adventure. You have to get a team of commandos inside an enemy weapons establishment. You have maps to help you and there are seven skill levels. Find out more from: *MC Lothlorien, 56a Park Lane, Poynton, Stockport, Cheshire SK12 1RE*



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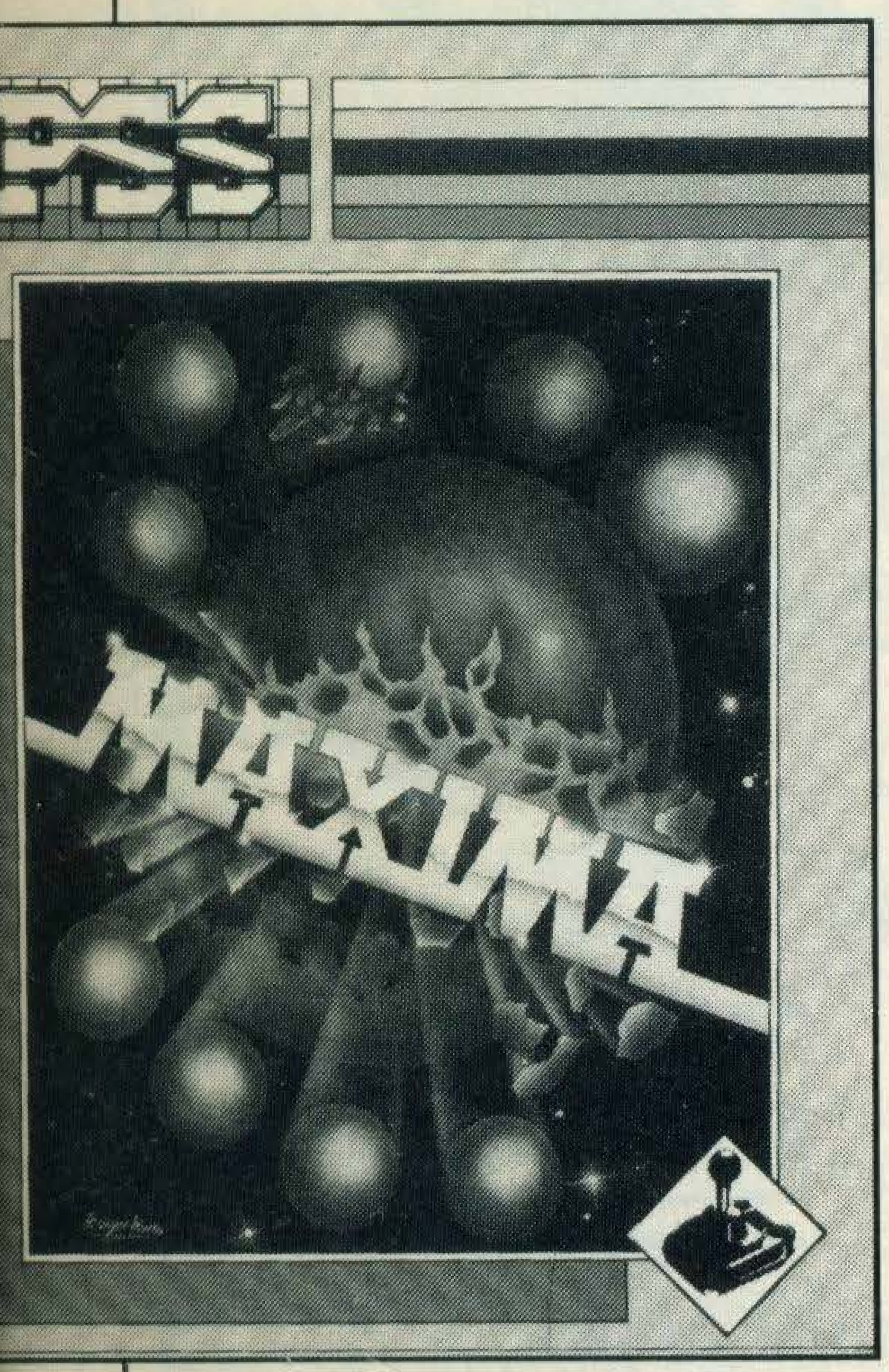
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AVAILABLE IN THESE SHOWROOMS. PLEASE SEE YELLOW PAGES FOR ADDRESSES AND TELEPHONE NUMBERS.

International MSX only electronic mail network comes on-line



PSS PICK SPECTRUM GOODIES FOR MSX

Personal Software Services, or PSS for short, have four titles lined up for MSX computers. All have been converted from existing Spectrum programs. All will be on cassette and games are priced at £7.95.

Les Flics has the Pink Panther as the main character. He has to find a gemstone, avoiding police and all sorts of obstacles en route.

Maxima is a space shootout. You must meet and beat 16 varieties of alien enemies, each attacking in a different formation.

In Time Bandits you guard a convoy of trucks. In doing so you are transported to different time spheres, to do battle with zeppelins, biplanes, helicopters and other more futuristic flying machines.

Champ is a sophisticated assembler/monitor with a disassembler, memory move and single step functions. It is to let you write or debug Machine Code programs. It costs £12.95.

Personal Software Services can be contacted at 452 Stoney Stanton Rd, Coventry CV6 5DG.

MSX LINK TO WORLDWIDE MAINFRAMES OPENS — £10 CHARGE FOR NON-PRO USERS

MSX-Net is the name of a potentially vast international network of MSX computers linked by telephone lines and large mainframe computers. And in case you think it sounds like another computing pipe dream, you should know that it's already running in the UK.

The idea is that you use a modem to connect your MSX computer to the national telephone network. It is patched into a central computer (one of four operating in London) and you can access your own electronic mailbox.

You'll be able to read electronic mail left for you, send electronic mail and dip into the general MSX-Net pages. These will include software that can be downloaded to your computer, magazine pages, help lines and so on. You'll also be able to access various data bases, at home and abroad.

There are two levels to MSX-Net. The professional level is costlier but carries extra facilities. Professional users will have access to restricted pages of trade information, will be able to set up private pages for use by certain subscribers only, free training and other professionally orientated services. Pro users will also be able to use non-MSX computers on the network.

Hobbyists will have to provide proof of purchase of an MSX machine to get a box on MSX-Net. To fit a modem, you'll need an RS-232C cartridge, currently being marketed by Kuma and JVC. These will come with MSX-Net application forms. You'll also need a modem or acoustic coupler and a new style telephone connector. Equipment costs will be under £100.

Buying the Kuma or JVC cartridges will give free membership of MSX-Net for the first year. Thereafter the subscription is £10 per annum. Usage charges will depend on the time of day, with lowest rates from 7pm to 8am when the connection charge is 3.5p per minute. There is a storage charge for material stored in your electronic mailbox, and charges for overseas connections will be higher.

Each box user will have a password to prevent unauthorized access. Passwords can be changed as often as is desired.

The types of data bases that can be accessed from MSX-Net are varied indeed. There are many huge adventure games to play, files of business information, chat lines and much much more. It's all part of the booming business of electronic communications, and owning an MSX computer can get you involved in that boom.

Both *What MSX?* and its sister magazine *MSX Computing* have taken out MSX boxes. We will be offering all sorts of services, so watch this space.

Further details available from: MSX-Net, Room 18, Southampton House, 192/206 York Rd, London SW11 3SA. 01-350 1931. 83:MSX002

CRL CONVERT OMEGA RUN, GLUG GLUG FOR MSX LAUNCH LIST

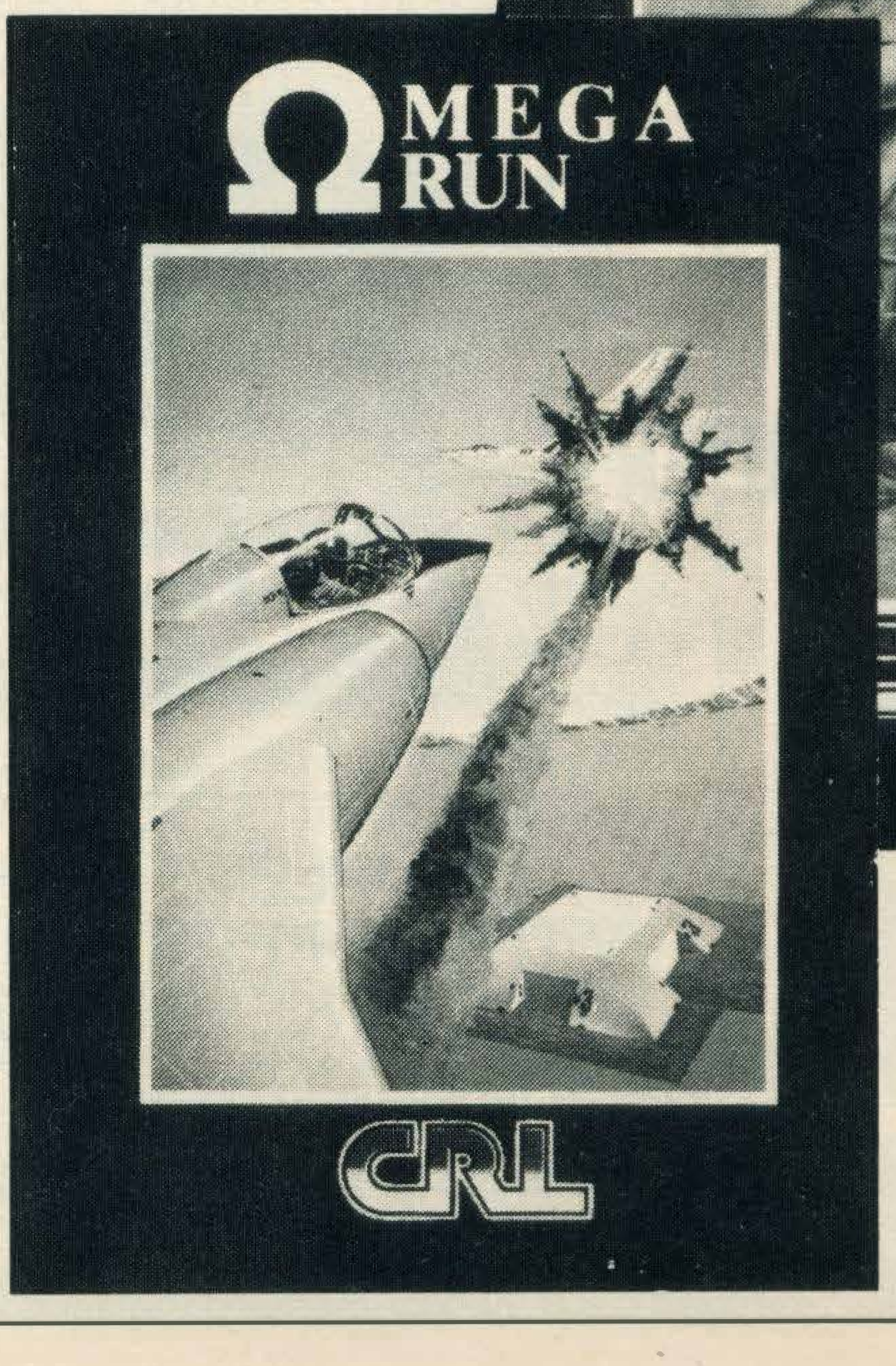
Computer Rentals Ltd. (CRL) are converting two of their Commodore 64 titles to run on MSX computers. They are Omega Run and Glug Glug.

The former is a flight simulator. In a race against time you must pilot your bomber to an enemy missile silo and destroy it. On the way you'll have to beat other aircraft, missiles and anti-aircraft fire.

Glug Glug puts you in the role of a deep sea diver after sunken treasure that is guarded by all sorts of menacing creatures. You have a dart gun with which to defend yourself. Computer Rentals can be contacted at:

Computer Rentals Ltd, CRL House, 9 Kings Yard, Carpenters Row, London E15 2HD.





Deep sea diving thrills and air battles in store for CRL MSX buyers

Budget computer from Korea smashes £250 MSX price barrier

MSX GERMAN SHOW DEBUT

MSX made its presence felt at the recent Düsseldorf hi-fi show, with eight manufacturers displaying their wares.

Philips had three machines being shown to the trade only. The most prominent machine was the MSX-8000, a 32K computer to be sold for around 800DM (around £220). It was constructed in France by the Thomson/Brandt companies.

Japanese manufacturers with wares on show included JVC, Toshiba, Yamaha and Pioneer. The Pioneer machine was the 64K PX-7, complete with extended BASIC.

Several non-Japanese companies had MSX machines on display. AVT Goldstar, the Korean micro makers, had their budget machine on view. Samsung, a Taiwanese company, were showing a 64K computer planned for release in mid 1985. Daewoo also had a Korean made machine visible, though no details were available. It now looks like MSX won't be a solely Japanese phenomenon.

BASICODE INTERPRETS

THE CHIP SHOP 4
RADIO 4
BBC RADIO'S COMPUTER PROGRAMMES

The BBC, in conjunction with Radio 4's popular *Chip Shop* programme, will be offering a MSX version of their Basicode interpreter. From September 29th, listeners will be able to take advantage of free Basicode software broadcasts. Basicode is a subset of BASIC, allowing programs to be written which are portable across a wide range of machines, including the Spectrum, BBC B, and Dragon.

If you want to know more, ask: Broadcasting Support Services, PO Box 7, London W3 6XJ. Tel: 01-992 5522.



MICRODEALER TO HANDLE FULL MSX SPECIFICATION MSX GOLDSTAR MICRO

A full standard 64K MSX computer complete with word processor and interactive data base software for less than £230 sounds like a wind up. It's not, and if you visit your local Spectrum computer dealer he'll prove it to you.

The machine you'll be offered is the Korean-made Goldstar, imported by Microdealer UK Ltd. It will be in the shops by the end of November and is sure to attract plenty of attention.

Goldstar are a Korean company with a turnover of £7,000m. They have purchased an MSX licence and implemented the specifications completely. There's a full QWERTY keyboard, a cartridge port, a 50 pin I/O port for disk drives and so on — everything you'll find on other MSX computers. The only difference is the low, low price.

Microdealer UK Ltd are also planning a range of peripherals under the Shado brand name. The range is to include a disk drive, touch tablet, light pen, a cassette recorder, joysticks and more. They will also be built in Korea by the Goldstar company.

Hardware buyer Dudley Langmead explained that he expected purchasers of one brand of Japanese computer to be loathed to buy peripherals from another competing brand maker. 'We reckon they'll be more likely to buy a third party peripheral, particularly if the price is attractive.' Expect Shado accessories to start appearing in 1985.

More details on the Goldstar are available from: Microdealer UK Ltd, 20 Burrowfields, Welwyn Garden City, Herts AL7 4SS. Tel: (07073) 28181.

MSX HITS FRENCH BEACHES

Juan le Pins in the south of France was the venue for the launch of the MSX system. Organised by the MSX Group, a co-operative body representing seven major MSX manufacturers, it was a chance to see the sort of things the MSX system has to offer.

Machines from Sony, Canon, Hitachi, JVC, Toshiba and Sanyo were up and running. Each manufacturer also provided samples of various MSX peripherals.

Toshiba had a disc drive, their four colour printer/plotter and an 80 column dot matrix printer on show. Sony were demonstrating a super paintbox program, working with a sensitive trackball. They also had a disc drive. Sanyo had their light pen up and running, with a paintbox program.

MSX-Net was also demonstrated, with links established to New York, London and Paris over a hotel 'phone line. Both Kuma and JVC had their RS-232C communications cartridges on show.

MSX
HOME COMPUTERS FROM HOUSEHOLD NAM

Sunrise logo for MSX co-operation group

What is MSX?

You've heard the name, but what does it mean? What does it offer? Read on and find out

You're going to hear so much about MSX in the future that it will become as much a part of your vocabulary as Hoover, Sellotape or VHS. MSX is the new standard in computing, one that is going to revolutionise the home micro industry.

Computers have had a profound impact on our society already— it is almost impossible to avoid them. Children use computers from pre-school age. An increasingly large number of offices are com-



What is MSX?

puterised to some degree. Hundreds of new companies have sprung from nowhere, generating a boom industry in the midst of a recession. Sixteen year olds make fortunes in their spare time; inventors earn knighthoods. Magazines seem to spontaneously reproduce and even newsagents have racks of computer games on sale. The long-awaited computer revolution is in full flight.

Until now, the Japanese have played a relatively minor role in the boom. They have launched a few home micros (from Sord and Sharp for example), and gained a good reputation for building reliable printers, disc drives and other peripherals. However, British and American companies have cornered the lion's share of the market, thanks to computers such as the Sinclair Spectrum, Commodore 64 and Acorn's BBC micro.

The Japanese have not been idle. They looked at what was going on and not all they saw was to their liking.

Multinational corporations such as Sony, JVC and Canon have got where they are today

'Even 28 days is apparently measured in months, not weeks'

because they hold certain principles very close to their conglomerate hearts. Conformity, standardisation, upward compatibility, mass marketing and so forth are buzz words in Japanese boardrooms.

These buzz words don't carry quite the same weight over here. If anything, the reverse applies. Standardisation is as rare as sand at the South Pole. There is virtually no compatibility between computers, even from the same maker. Marketing is a low priority, and consumers are subjected to often appalling disinformation. And even 28 days is apparently measured in months, not weeks.

MSX will put all this to rights. Woebetide the computer manufacturer who sticks to the old ways. What happened to the hi-fi, motorcycle, photographic and watch industries is about to happen to the home computer industry.

Why is there a problem anyway? Are the problems the invention of MSX advocates? Is standardisation needed?

A computer on its own is about as much use as a book without pages. It needs a screen for the display, programs to make it do things, devices to store programs, printers, joysticks and all sorts of other peripherals. The trouble is that what fits one make or model of computer may not fit another, even if it is made by the same company.

For the would-be computer owner, this is a bewildering situation. Not only must the sizeable differences between machines be weighed up, but the number of programs and peripherals available must be considered. If the computer is not already established, the buyer is gambling that it will catch on. Those who bought computers like the Lynx, Ace or Aquarius lost their gamble and were no doubt very annoyed. Buy the wrong computer and in a non-standardised world, you could be a loser.

With MSX, there are no such worries. Any machine meeting the MSX standard will take any MSX peripheral or program. The purchaser is not gambling on the future of the system.

Software houses face a similar situation. Unless they have unlimited funds, they have to specialise in a handful of machines. Many software houses devote themselves to one machine only, thereby restricting their total market. Backing the wrong machine or manufacturer can have disastrous consequencies.

The problem lies in that different computers use different components and languages. Programmers tend to specialise in one system, and to 'transport' a program from one system to another usually involves hiring another programmer. Another problem is that what looks good on one machine often fails to impress on another system. Software houses are thus restricted by the variety of systems around, and their fortunes lie in the hands of the computer maker and his marketing team.

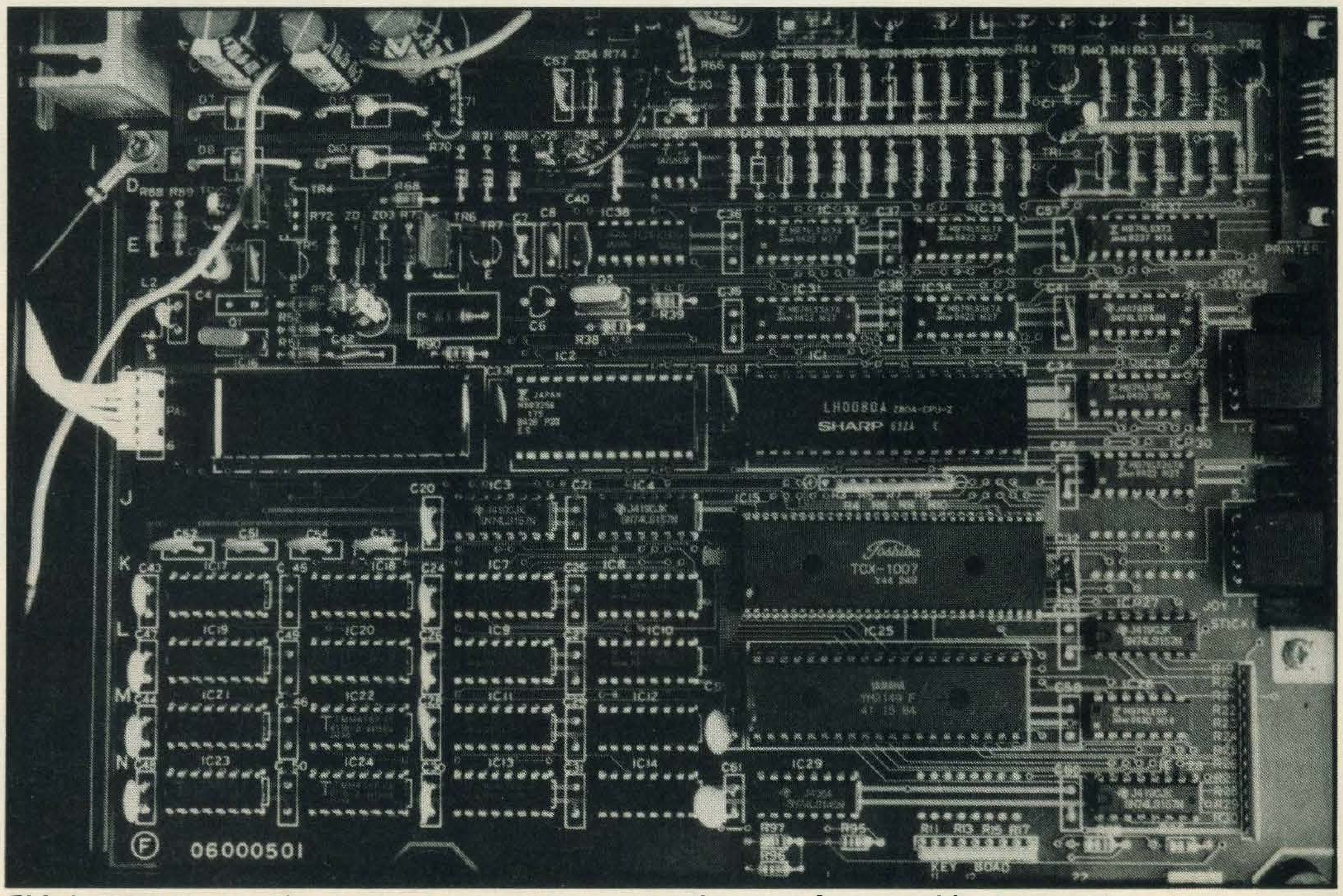
The MSX system solves this problem. *Any* MSX program will run on *any* MSX machine, and programmers need only learn how to write MSX programs in order to reach millions of potential customers. The risk factor is diminished, software companies have a wider market for their products and there will thus be more software to choose from.

This is good news for the user too. At present, you might see a game or a business program that is the answer to your prayers. Trouble is that it is not written for the computer you own, or the version for your computer is not nearly as good as the original. MSX means users won't be so restricted in their choice of software.

Much the same can be said about the peripheral market. There are already some *de facto* standards (such as the Centronics interface for printers), but all too often you are restricted in the items you can fit. Some computers accept only the maker's own data recorder. Some have odd joystick interfaces, or are severely limited in the number of peripherals available. Again this has to do with the popularity of machines, and is another case of independent companies having to gamble on the future of a new machine.

Now so long as a peripheral conforms to the MSX standard, the maker will know that there is a large number of machines it will fit. There will be more incentive to develop things such as robots, speech synthesisers and so on. That's good news for MSX owners wanting to expand their computer system to the full.

For the retailer, MSX is a Godsend. Rather than having to stock totally incompatible computers (and gambling on stocking the right machines),



This is MSX; these chips (with minor variations) stay the same from machine to machine

the retailer can stock the MSX machines they feel most confident selling. Sales assistants won't have to learn to demonstrate a dozen different computers, and will be able to learn about the one system in depth. Shops won't have to stock a dozen different varieties of the same programs, nor different peripherals for different computers. Nor will stock shortages be so much of a problem, as any other brand of MSX unit can be sold instead of an out of stock item.

So, standardisation is going to bring benefits all round.

MSX computers will also open up a whole new sector of the consumer market. There are millions of people who have put off buying computers because of the problems of compatability, because of the 'gamble' factor, because there is so much instability in the market and because the industry is still largely an industry of buffs and boffins.

Now that the huge electrical companies, with household names and solid reputations have arrived on the scene, all that is about to change. Consumers trust the names Sony, Pioneer, Yamaha and so forth. Computers will be sold in a similar way to hi-fi, cameras and video recorders — consumer electronic products for which a university degree is not necessary. Existing computer owners may feel slighted by this populist approach, but a larger number of computers being sold is actually good news for everyone.

The affect on the home industry will be interesting. Software houses and peripheral makers will have a whole new market to cater for, but they will be thrown into a more competitive field, with imported products fighting for the same customers, and new rivals to contend with. This is bound to improve the quantity and variety of software, though there will be some companies who fall by the wayside.

As for existing computer makers, those with entrenched positions won't be threatened immediately, and may well survive on their existing user base. Sinclair, Commodore and Acorn are in this position.

Other companies will be more vulnerable. Their best option may be to buy an MSX licence, on the principle that if



you can't beat 'em, join 'em. Developing overseas markets may give a temporary respite, but the MSX companies have their eyes set on worldwide domination too.

The fact that the marketing expertise of these huge companies will be brought into play is another important factor in the MSX plot. A generic campaign on the MSX concept is already underway and is selling the concept of the home computer to countless potential users. Each company will have a large advertising budget to spend, and the net result will be a very high public awareness of the MSX concept. That, coupled with the brand names involved, is going to make the home computer more acceptable than ever before. The computer revolution is going to move forward at an even faster pace.

The idea of MSX, the companies who are implementing it and the backing they are getting is thus certain to establish MSX as the standard in 8-bit home computing.

Critics can't deny this, but many claim that the MSX standard is based on outdated technology and it will be almost impossible to incorporate new developments. The Z80A processor has been around for a long time — in industry terms — as have the sound and video chips. To some people, old is out.

For others, old means proven, and the experiences of manufacturers launching products using the latest technology has demonstrated the drawbacks of new technology. Old also means inexpensive. Unexpected problems arise, components are more costly, may be in short supply and delays in development are common. It is evident that there is a high risk in using the latest technology. The 'old technology' critics also seem to overlook the fact that the MSX specification is a minimum standard. There is nothing to stop manufacturers from adding *more* features as in Pioneer's P-BASIC video-dedicated language, and similarly Sony's start-up menu and data cartridge memo pad.

The MSX components are all proven, readily available and affordable. Programmers and computer designers are experienced in the application of the various chips, so their potential can be exploited to the full. Familiarity is an asset.

'New developments can be incorporated into the machines without making them obsolete'

Those who developed the MSX system claim that it is 'future proof', and that any new developments can be incorporated into the machines without making them obsolete. 'Upward compatibility' is the newly coined buzzword to describe this.

Whether these claims prove to be true will only be seen with the passage of time. Given the past track record of the companies involved, we are prepared to give them the benefit of the doubt.

MSX is the brainchild of a Japanese company called Kabushi Kaisha ASCII. In collaboration with the American software developers, Microsoft, they developed Microsoft Extended BASIC. The partners then sold the idea of MSX to the top electronics companies, achieving a degree of standardisation that many had previously thought impossible.

As BASIC languages go, MSX BASIC is not radically different from other Microsoft BASIC variants, with the exception of Sinclair's BASIC. That's good if you already use a home computer, as your existing knowledge of BASIC programming can be put to good use.

Compared to other BASICs, MSX BASIC is flexible, friendly and well equipped. The use of function keys for limited single key entry, the excellent sound facilities, sprite graphics for fantastic screen images — all this adds up to a BASIC that will impress many users. Providing the documentation is good, and book publishers act with their usual speed, BASIC programmers will take MSX BASIC to their hearts.

MSX could well become part of a whole range of consumer goods. TVs, video disc players hi-fi, washing machines, and almost all the electronic goods in the home could eventually incorporate MSX compatible circuitry. Plug your MSX computer in, run a program, and the future is in your hands.

These, then, are some of the reasons why we have so wholeheartedly welcomed the MSX system. It is a system that has been planned to benefit the consumer all the way down the line. It is a system that has the support of some of the biggest names in the consumer electronics world. It is a system that has been designed with the future in mind. And it is a system that belongs in every home.

In the not too distant future, the MSX computer is going to be as much a part of the home as the telephone, the television and the car. Join the computer revolution now. ■

Central Processing Unit (CPU)
Zilog Z80A or equivalent, running at a clock rate of 3.579545 MHz.
Memory
ROM — 32K of Microsoft MSX system software. RAM — 8K minimum. Both RAM and ROM are extendable.

Video Display Processor
Texas Instruments' 9918A or equivalent

Display Modes
High resolution — 256 × 192. Text — 40 × 24. 16 colours available. Optional 80-column text screen

Sound generator
General Instruments' AY-3-8910 or equivalent

Cassette Interface
FSK modulation. 1200 or 2400 baud transfer rate

Character sets
Alphanumeric, European, Graphic
Keyboard
73 keys, minimum

Expansion slot
Software cartridge and expansion BUS slots

Joysticks
Minimum of one, Atari plug compatible

System clock
Battery backed-up CMOS

Communications interface
RS-232

Printer Interface
Centronics parallel port

Programmable Peripheral Interface
Intel i-8255 or equivalent

The CPU is the heart of a microcomputer, where all the number crunching takes place. The Z80A processor, the heart of all MSX micros, is already used in Spectrum, Amstrad and many small business machines. It is widely available and has proven to be reliable.

ROM, or Read Only Memory, is fixed and is what makes an MSX computer run a program written in MSX BASIC.

RAM, or Random Access Memory, is the memory taken up by programs. Most of the MSX machines for the UK market will have 64K of user RAM, plus 16K for use by the video chip.

Some computers may offer more ROM, to give additional BASIC commands, or more RAM, for larger user programs. Plug-in cartridges are available to extend the memory.

This chip controls what appears on the screen. It allows the use of sprites, up to 16 colours and a sophisticated set of graphics commands.

High resolution, or Hires, screens are used for graphics. They display an area of 256 pixels across by 192 pixels down.

The text screen can also show simple graphics, with a maximum of 40 characters across by 24 characters down. An optional 80 column display is available.

This chip will generate up to three separate music tones, and an electronic 'white noise' tone. The music can be over an eight octave range, and there are 10 sound 'shapes' pre-programmed.

Any normal cassette or data recorder can be connected to an MSX computer. Programs are recorded in two tones (described as Frequency Shift Keying modulation), and at data transfer speeds of 1200 or 2400 bits per second (1200 or 2400 baud).

MSX computers support English, French, German, mathematical and even smiling face character. Each key can give up to four different characters. Some machines, such as the Spectravideo, also have a separate numeric keypad.

Program cartridges, data cartridges, modem interfaces and so forth can be plugged into these sockets, to expand the MSX system for specific purposes.

Any of scores of joysticks can be fitted to MSX computers. Most will take two separate joysticks, and they will be used extensively in games programs.

You will be able to attach diary or time keeping programs to your MSX computer, and they will keep time independently of a mains power source.

A separate cartridge will give an RS-232 interface, for fitting peripherals such as modems, speech synthesizers, servo motors and so on.

Any printer with a Centronics interface can be fitted to and controlled by an MSX computer. Othe Centronics peripherals may be attached too.

This chip controls the input and output to cassette recorders, disc drives — any general interface. It is what enables an MSX computer to communicate with the outside world.

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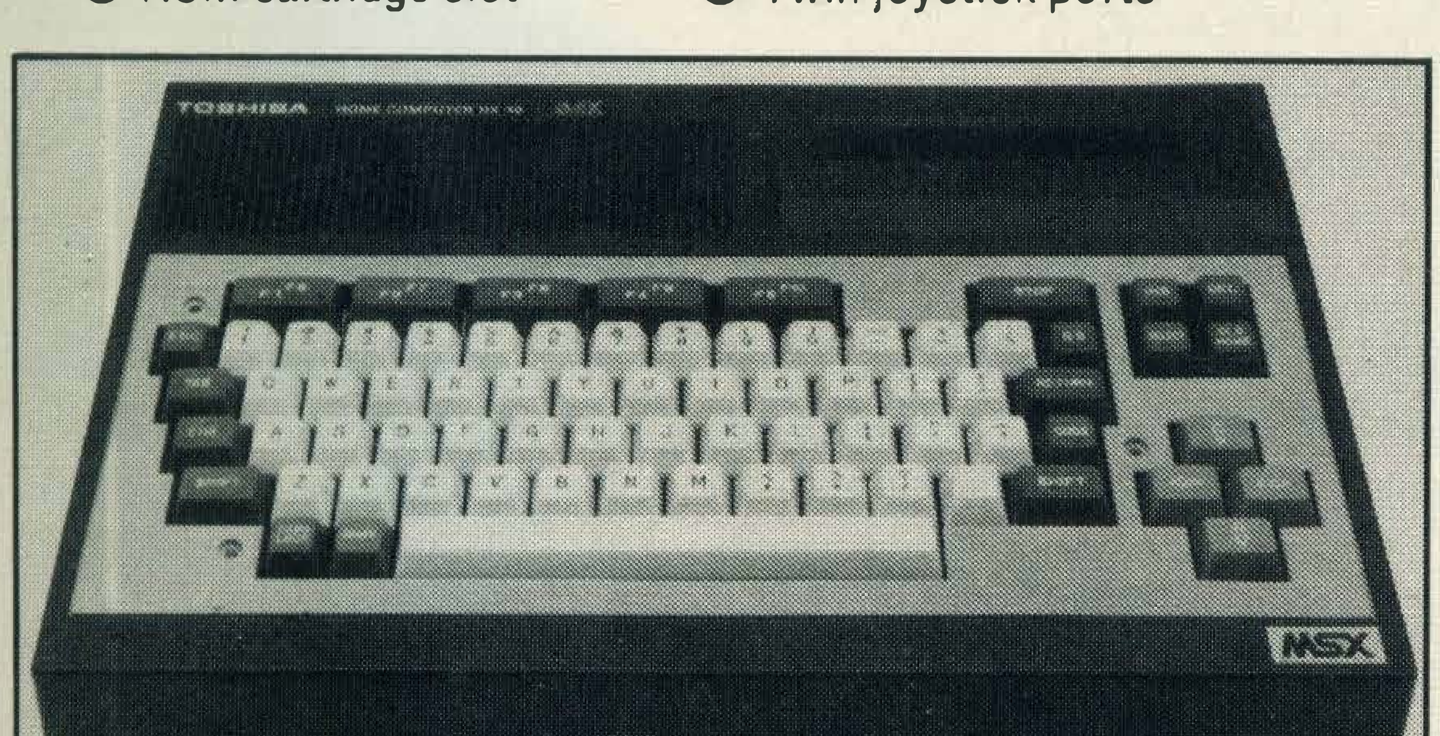
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MICROS—LIFE BEYOND 'THE BOX'?

Tune your TV into the micro revolution. Steve Mansfield looks at the work and leisure possibilities

There it sits, in pride of place by the TV. While the rest of the family waits in vain for *Crossroads*, your newly unwrapped MSX computer hums quietly to itself. It's plugged in, switched on, tuned in and generally raring to go. Pretty exciting, huh?

Well, as a matter of fact, there are few things less exciting than a quietly humming computer. The machine has to be brought to life. Then you start getting all the colour, action and entertainment you were promised in the brochures. The way to bring this about is to give the machine something to do.

But what exactly is the micro useful for? That's actually a very broad question. Some people buy computers because they are interested in them as machines. Other people use them to help out with some other, unrelated hobby interest.

Having returned hotfoot from the shop, the salesperson's patter is still raging in your head, full of possibilities and baffling jargon. Somewhere in that verbal tidal wave you can probably pick out words and phrases about word processing, databases, financial planning and the like. This machine, you've been told, will make sense of your home accounts, turn you into a graphic design genius, keep a record of your stamp collection and educate your children. These are possibilities, of course. Many people discover hidden talents when aided by a computer, and the discipline involved in programming or handling these machines can help to make you more organised. But a quick look through the magazine ads will tell you the most common use for home computers — games.

Let's get this straight. There is absolutely nothing wrong with playing games on a computer. On the contrary, games can be a lot of fun, and are some of the most elegant

'As a matter of fact, there are a few things less exciting than a quietly humming computer'

example of programming to be found. Because of their popularity, with correspondingly high profits, many of the best and most imaginative programming talents have been swallowed up by the computer games industry.

There is, unfortunately, a tendency for many people to be dismissive about this area of computing. It's a hangover from the Victorian work ethic, where anything without a serious application is somehow frivolous and not worthwhile. As soon as you get a computer someone is bound to ask: 'What's it for?'. There's no reason why the answer shouldn't be: 'Fun!'.

The leisure industry is one that's going to grow rapidly, as we are all likely to have more time on our hands in the future. There is no doubt that computers will play a part in helping people cope with leisure time in the same way they have helped with work.

The main problem with games is that some of them are so addictive! The mere mention of aliens can start trigger fingers itching. You can tell the arcade game addict by the haunted look — a result of playing through the night. While the sun rises, the cat comes back for its breakfast and the neighbours wonder where the noise is coming from, the kill-o-zap junkie tries 'just once more' to better the high score record.

Adventure players tend to be more sedate and thoughtful, though no less hooked. They retreat into the complexities of their fantasy worlds, and can sometimes be seen swathed in sheets of paper covered in strange runes, hastily scribbled maps and comments.

It's quite possible that you will never use the computer for anything but games. Most of the machines sold are used

'Let's get this straight. There is absolutely nothing wrong with playing games'

that way. There are computer owners out there who wonder why one of the keys is marked **ENTER** when it should obviously be **FIRE**. Others muse over the large number of keys — why have seventy-odd when all you need are **UP, DOWN, LEFT/RIGHT, SHOOT** and **HYPERSPACE**?

Nevertheless, some pundits have remarked that there seems to be a move away from games. In spite of efforts by programmers to make them more interesting, there are



many micro owners who feel they want something more from their machine. This is where the MSX concept is so strong, because your system does not stop with the computer on its own.

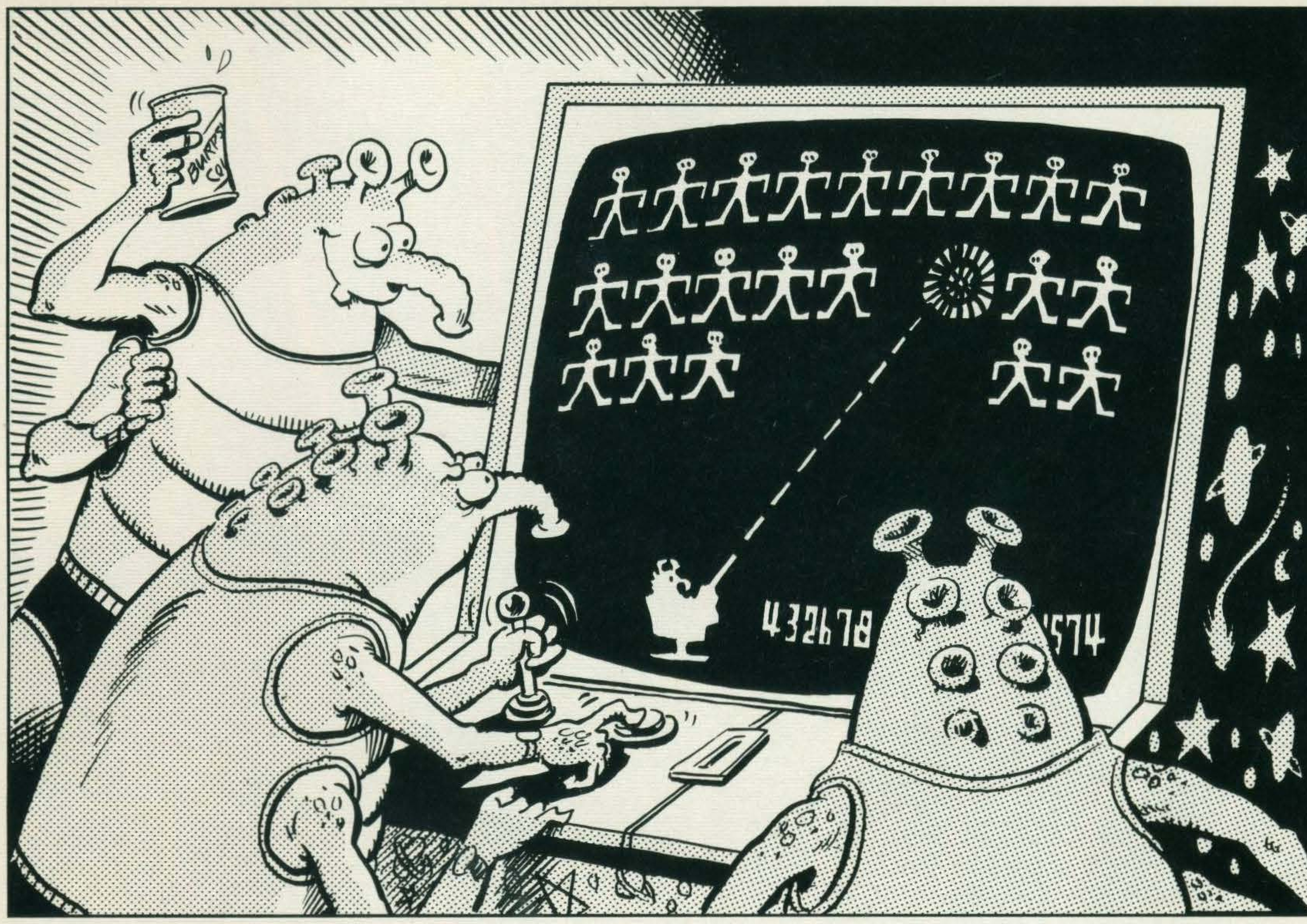
Each MSX micro is bristling with sockets for various peripherals and expansion systems. This is not new, of course. But it is the particular expansions provided or planned for the machines which is most exciting.

Joystick sockets may seem an obvious inclusion. Both games and graphics packages can be vastly improved by using joysticks. But with some micros you need a special interface, which has to bought separately, to fit them. MSX micros have two sockets.

There is a standard parallel output socket, intended mainly for printers, a cassette interface, while you have a choice of normal TV or monitor output. But the biggest plus is the main expansion socket.

All MSX machines have at least one cartridge slot, and most have a 50-pin socket, which is another way of achieving a similar thing. As well as allowing you to fit games cartridges (with their inherent advantages of speed of loading), you can also slot in a variety of versatile hardware extensions.

To give a few examples,



Spectravideo (and most others, in time) have an 80-column card, giving the type of screen necessary for most business software, word processing, spread sheets etc. This sort of card can also carry the necessary software (in ROM) to run CP/M — the industry standard business operating system.

The Pioneer and JVC MSX machines are heavily biased towards video. It actually has some extra commands built into the BASIC for editing and titling video tape. Until now this has been something way beyond the average enthusiast, because of the complex and massively expensive equipment needed. But soon it could be within reach of many dedicated amateur video movie makers.

Several manufacturers intend to have video disc interfaces. This gives the machines some incredibly powerful facilities. The most dramatic is interactive video games. Anyone who has played the arcade versions, which use video recordings of real scenes with computer generated graphics superimposed, will know how mind warping and exciting these games are. They're the ultimate in realism. Hang on to your seats.

'In a matter of seconds you can go from being Buck Rogers to Rick Wakeman'

Other applications for video disc are in databases. (A video disc has the potential to store a mind boggling 6 Giga byes). You can have encyclopaedias on disc which not only contain a great deal of text information but can also show film footage or still colour pics of events. This is where education by micro could really take off.

Video disc systems access information very quickly, so it's like having a 10 megabyte ROM in your machine. Professional computers already have something similar with hard discs. But these are large, expensive and hard-to-maintain machines. Video disc has none of those problems.

But it doesn't stop there. For those who are musically inclined, you can plug in a keyboard and turn your micro into a synthesiser. In a matter of seconds you can go from being Buck Rogers to Rick Wakeman, simply by unplugging a games cartridge and plugging in the keyboard. Yamaha should be the first with this option.

Perhaps one of the most fascinating developments in home micros recently has been the growing interest in communications. Most people are familiar with the one-way systems operating on TVs — Ceefax and Oracle. But with a micro and a modem you have the possibility of two-way data transmission.

Prestel, the British Telecom system, has been running for some time. This has a special area for those interested in computing, of which the best known part is Micronet. You have to access to micro magazines, software to download (some of it free), teleshopping, competitions, news, reviews and bulletin boards for your own messages. The rest of Prestel is almost too large to describe, but includes news, weather, and a vast variety of other information, even theatre ticket booking. And that's just one system. Other communications systems exist, and they'll continue to grow and develop.

'It could easily get to the point where most office workers could work from home'

It could easily get to the point where most office workers could work from home, using telephone data communications to send in reports, articles, and information. This is already happening in some areas, particularly journalism. MSX micros are easily capable of handling this sort of application.

So the list grows. There are disc drives for the business minded, light pens for budding digital Picassos, and the system has only just started! So what does it all mean for you?

As you may have gathered, the MSX micro itself is simply the heart of a system, which you can expand to suit your taste. Compatibility means that peripherals brought in by one company will work with any other machine, so you don't have to decide the direction of your computing system right at the beginning.

So, what are you going to use it for? If you already to home accounts, a micro could lick them into shape. If you really need a word processor, a micro is ideal. And if you run a club, or collect something, a micro may well help you to organise. And the versatility of MSX means that it will find uses in more areas than ever before. People who have no interest in computers as such will be buying them to write music, edit and title their video films, or to develop other hobbies.

What is more important is that many of the advances coming in the next few years — will be microbased. It's as well to be prepared.

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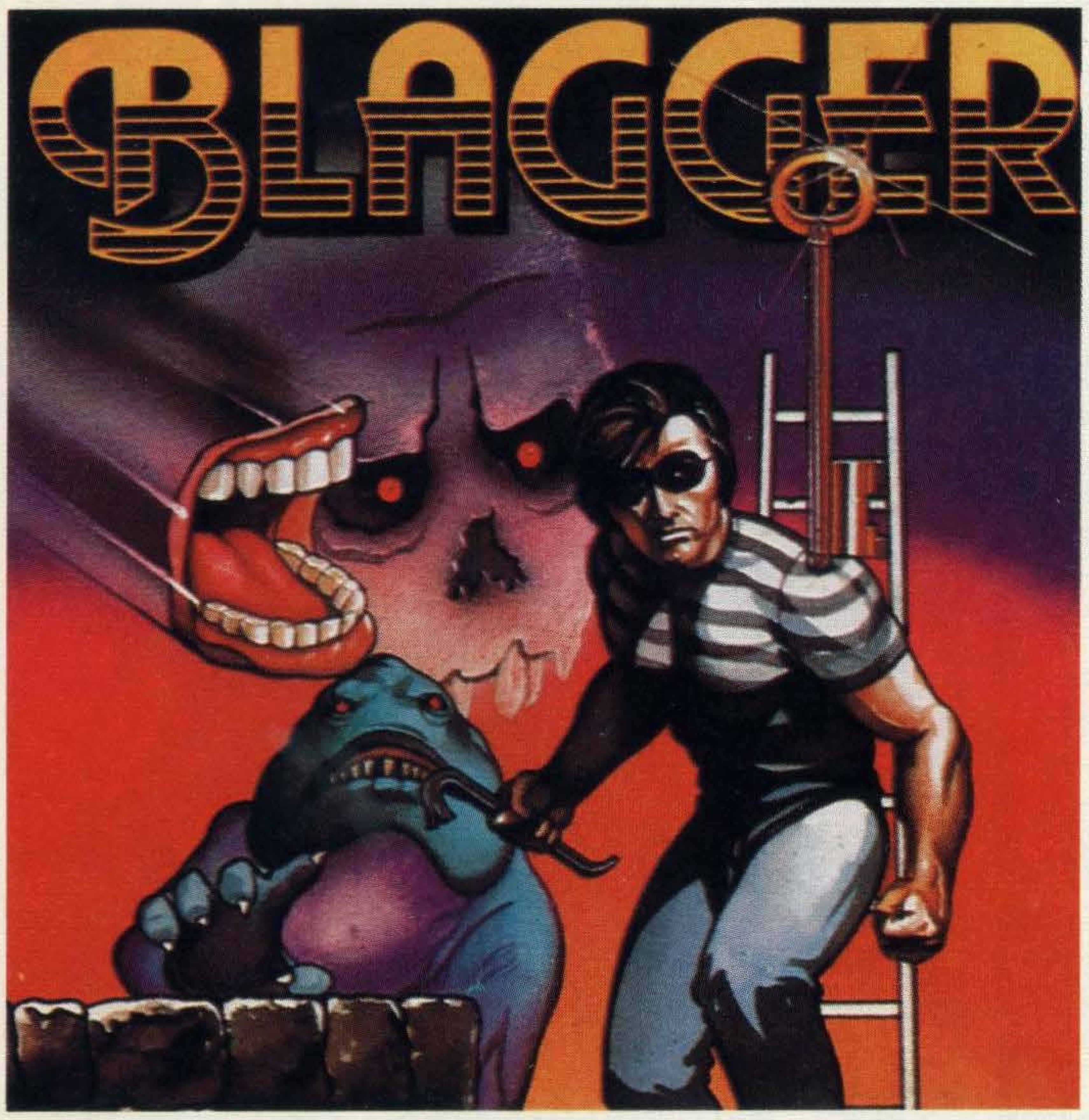
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SOFT FOCUS

Hold tight! Here we go. The first selection of MSX software, covering everything from aliens to utilities, is put under the careful, if somewhat bug-eyed scrutiny of our reviewers.

We managed to tear ourselves away from the screens long enough to put our opinions on paper. And to help you choose the best from the bunch, each program is given a star rating marked out of ten.



We steal a look at the first batch of software to arrive at our offices

TITLE Blagger
by Alligata Software Ltd.
PRICE £7.95 (tape)
TYPE Arcade game

Blag, vt: to steal, purloin, obtain illegally or without permission (as used in Minder, an early '80s TV comedy/thriller). Alligata certainly know their crook's jargon. Blag is a good and useful word. Blagger is a good and amusing game.

The game scenario is a familiar one. You have to get your hero, a swag bag toting criminal, through screen mazes filled with all sorts of odd nasties and pitfalls. You have to collect little golden keys — four or five to a screen — and then get to a safe. With all the keys, you are magically transported to the next screen.

You start in The Bank, move on to the Sweet Shop, then the Reactor, then Invaders from Space, and onwards. There are a total of 20 different screens.

The key to the enjoyment of this game is the 'solving' of the problems presented by each screen. There's usually only one sensible route for your man to take.

The screen designs are interesting and often witty (one called 'Our Logo' uses a giant Alligata symbol), and some of the nasties are nicely designed (in University House there's a mobile toilet with flapping lid!). You can play with either joystick or cursor/space keys.

There is also a practice facility, which allows you to start the game at an advanced screen.

The only quibble about Blagger is that getting started is time consuming. Our undocumented tape (pre-production) didn't exactly tell us much about how the game worked, and getting through The Bank took a lot of trial and error. (You need *all* the keys.) Once cracked, however, Blagger proved to be pretty compulsive stuff.

6

TITLE Driller Tanks
by Kuma
PRICE £8.95 (tape)
TYPE Arcade Game

Under an impressive ice palace is a network of tunnels. They are inhabited by various nefarious creatures hell bent on reaching the palace. You have a fleet of drilling tanks, and you have to beat the threat.

Control is by either cursor keys or joystick. Pressing the



space bar or fire button gives off a squirt that immobilises or destroys the enemy. As you move through the labyrinth, you drill out passageways too.

The more you drill, the more you score, and the faster you move. Points are gained for wiping out the bad guys too. Wipe out all the attackers, known as Hectoliens, and you move on to the next level.

Higher levels give more Hectoliens to do battle with, and consequently less chance of surviving.

Sound is minimal and you are spared merry tunes. The graphics are reasonably detailed, with bold colours and plenty of movement.

An excellent feature is comprehensive on screen instructions at the start of the game. If you get stuck, just watch through. There is no true demonstration mode.

Get 20,000 points and you get an extra life. Let a Hectolien reach your palace and you lose all your lives. There is a slightly tedious delay at the start of each life, but you can live with this.

You'll need quick wits and some clever strategies to proceed far in Driller Tanks. It is not a game you'll master in an hour or two. For those who like games that you grow into, rather than out of, this is not a bad effort.

6

TITLE Antarctic Adventure
by Konami
PRICE £15.20 (cart)
TYPE Arcade Game



If ever any game could be described as cute, this is the one. It is a huge hit in Japan, and likely to be so over here.

The aim is to get a penguin around the continent of Antarctica. The adventure has fourteen stages, each getting progressively harder. It is a race against time at each stage.

Your penguin waddles along quite merrily, tail and wings waggling. You can use either the keyboard or a joystick to control him. The fire button makes the penguin jump.

Along the way you have to avoid icy patches and yawning

crevasses. Ice makes you skid, slowing you down. You fall down crevasses, and have to scrabble your way out before continuing.

On the bonus side, there are green flags to collect and fish leaping through the air to swallow. Both add to your points. You also score by completing sections within the allotted time.

Other obstacles are the walruses that pop out of holes in the ice. You have to avoid them to make the best time.

The game is thus quite simple. The challenge is in beating the clock and completing each stage. At the end of each stage, you reach a house, the name of a country is displayed and the appropriate flag raised. The last stage is UK. At the Japan stage, the penguin smiles!

There is a tune to accompany the action — and after a while, it gets annoying. You can turn the volume down when this happens.

The graphics are excellent, bright and amusing. It is no wonder this game is such a hit. If you like cute games, you'll love Antarctic Adventure.

9

TITLE Cribbage

by Premier Microsystems

PRICE £6.95

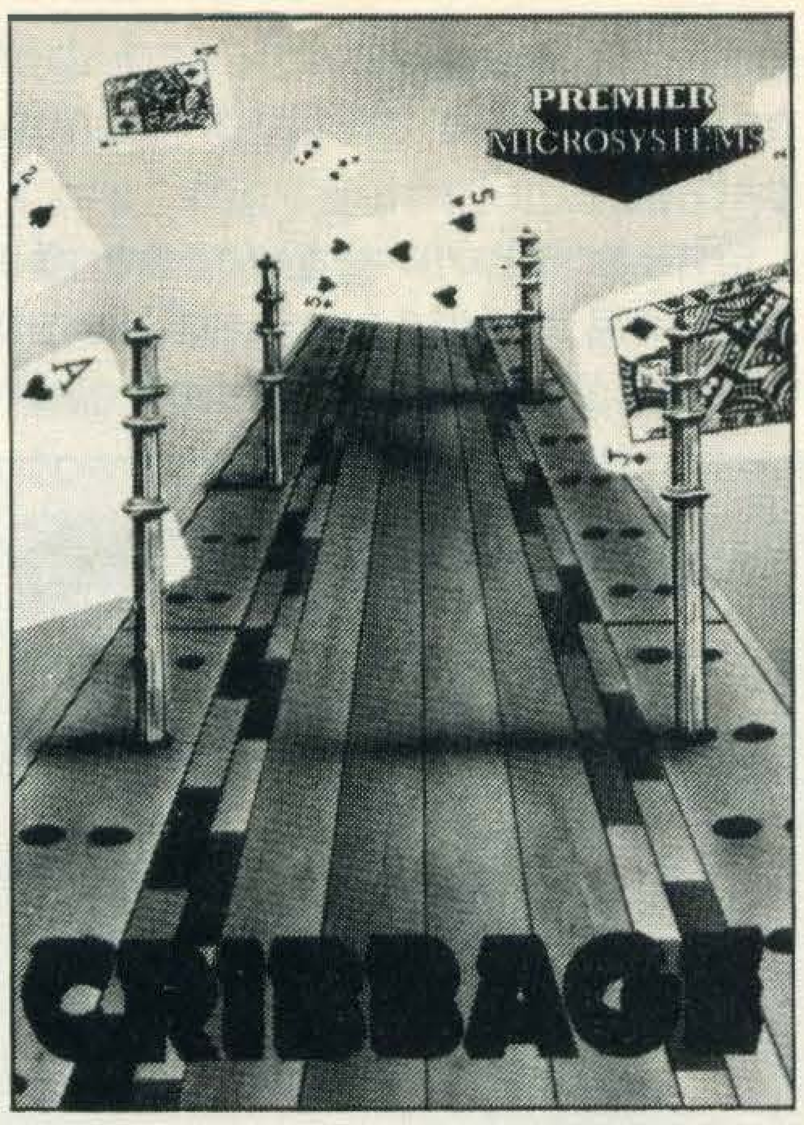
TYPE Traditional Game

Cribbage is one of those games that has been played in pubs and parlours for generations. Premier are one of a number of companies to adapt the game for MSX computers.

There's a simple opening screen, with a short tune. No on-screen instructions are given — the program assumes you know how to play the game.

Your six cards are displayed on a green background. Cards to be played or discarded are entered as 6H, 3C, QD and so on, with the relevant suit symbol appearing. As cards are played your displayed hand gets smaller.

During play bonus points and card stack totals are displayed. There are no sound effects or astounding graphics during the course of play.



At the end of each round hands are scored. This process is very quick indeed. Total scores are displayed and the first player to reach 121 wins. There is a repeat option.

The strengths of this program are its speed and the level of play. If you want to improve your cribbage game, this is a good means to do so.

The weaknesses are the rather static displays and score updating only at the end of each round. The Kuma version of cribbage has far better graphics, and if you are new to the game, this may be more attractive than a high standard of play.

At a price of £6.95, this version offers fair value for money. If you are a keen cribbage player, you'll appreciate its performance.

5

TITLE Binary Land

by Kuma Computers Ltd.

PRICE £8.95

TYPE Arcade game

A binary system is based on twos. Binary Land is a challenging maze game in which you have to get two characters to a centrally located exit, avoiding spiders and webs in the process.

That makes it sound easy. It's not. The complication comes from the fact that the two characters under your control move together in a mirror fashion. Push the left cursor key and the girl goes left, the boy goes right, if no obstacles are in the way.

Further confusion is caused by the two halves of the maze not being identical and having to get the 'lovers' to the exit at the same time. Getting the hang of character movements takes some time.

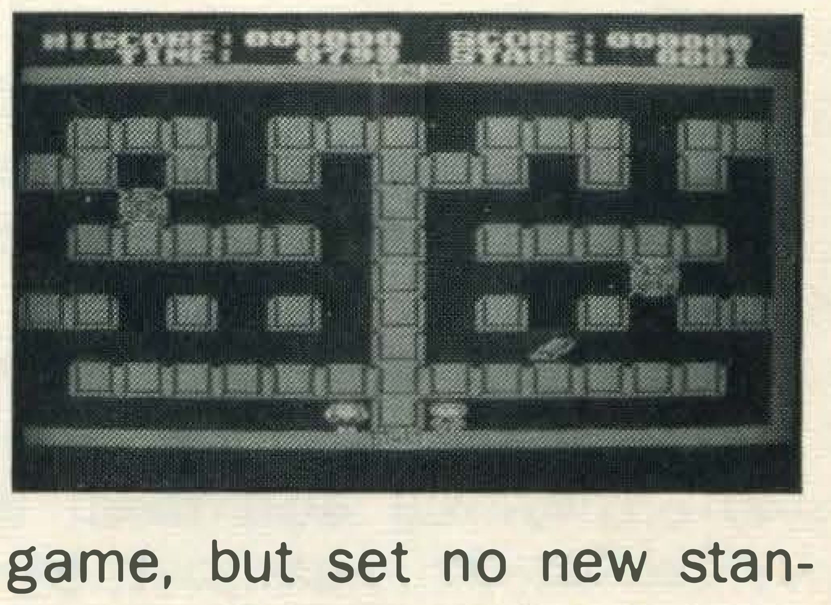
As if that wasn't enough, red spiders are out to get you and there are webs to steer clear of. You need your wits about you to move the characters together around the maze, avoiding webs and spiders.

Fortunately you have a weapon — a spray. This dissolves webs, kills spiders and gets you points. An annoying trait is that you can't squirt on the move.

Getting stuck in a web immobilises a character but help may be at hand from the partner and spray.

All this action takes place against the clock. You get points for completing each screen and there is a high score feature.

Graphics are rather simplistic and chunky. They are adequate for the nature of the



game, but set no new standards. Sound is used sparingly.

Binary Land scores for an original concept, and will take time to master. A little pricey it may be, but if you like unusual games, this one belongs in your collection.

6

TITLE Hyper Olympic I

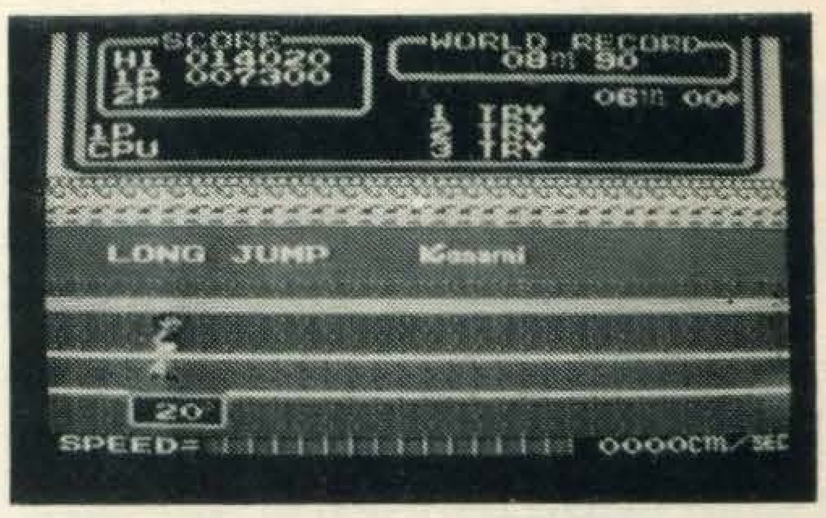
by Konami

PRICE £15.20 (cart)

TYPE Arcade Game

You know that feeling. You've trained for two years, and when you finally get to Los Angeles you get struck down by flu or Zola Budd just as you're about to finish last in the 1500m final. Its not a nice feeling.

It's a feeling we've been getting used to. Setting world records in the 100m, the long jump, and the 400m is easy, but when it comes to the hammer we're defeated. It could be something to do with body shape, but we reckon it's more to do with the fact that the hammer throw part of Konami's excellent MSX cartridge version of the popular 'Track and Field' arcade game is pretty damn difficult.



The game plan is fairly simple. You have to get through 'qualifying rounds' in four sports, using a combination of high speed cursor key bashing and judicious spacebar pressing. Each round gets more difficult.

The 400m in 40.00 seconds is also a bit stiff, and can lead to severe finger cramp. You can play this game with the joystick, but in practice we never found a 'stick that gave the speed we wanted.

Graphics throughout are excellent (which is probably why there are only four sports — some other versions have up to ten), and my only criticism would be that there isn't a 'practice mode' for each sport — especially the hammer. You can spend ten minutes piling up a good score only to get dumped when hammer qualifying reaches 95m.

In Japan this game has proved so popular, and so destructive of cursor keys, that some companies have been driven to producing special plug-in Hyper Olympic play buttons.

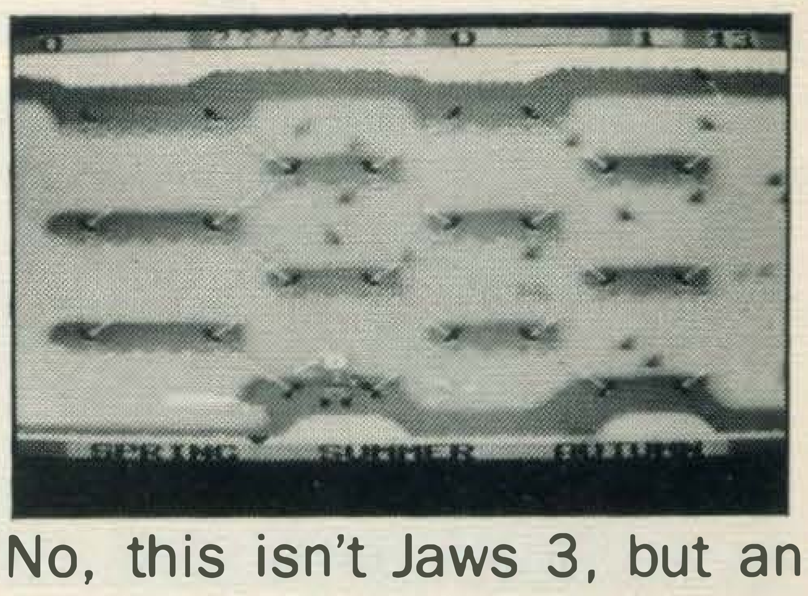
8

TITLE Shark Hunter

by Electric Software

PRICE £9.95

TYPE Arcade Game



No, this isn't Jaws 3, but an arcade style game where you can get your revenge on Jaws and all the rest of his sharp toothed relatives.

You are an eskimo whose job it is to protect the village's fish stocks from the ravages of sharks and ice floes. The fish are kept in pens formed by nets slung between islands and the banks of a river estuary.

As sharks and ice floes wreak havoc with your nets and fish, you leap from island to island mending and reinforcing nets, harpooning sharks and swimming an impressive front crawl.

Along the bottom of the screen a pointer moves from left to right across the words Spring, Summer and Autumn, telling you what season you have reached.

We played the game with a joystick which makes it easier to control the eskimo than the keyboard option, but nevertheless the game is pretty hard to play.

This difficulty is caused by the harpoon throwing mechanism. You aim by holding down the fire button and moving the joystick. You fire by letting go of the fire button. But as soon as you do that, the eskimo starts moving in the direction of the joystick, just as you would expect with joystick control, and ends up as tasty shark fodder.

The graphics are excellent, the sharks' movements realistic and their demise spectacular. Highly recommended.

8

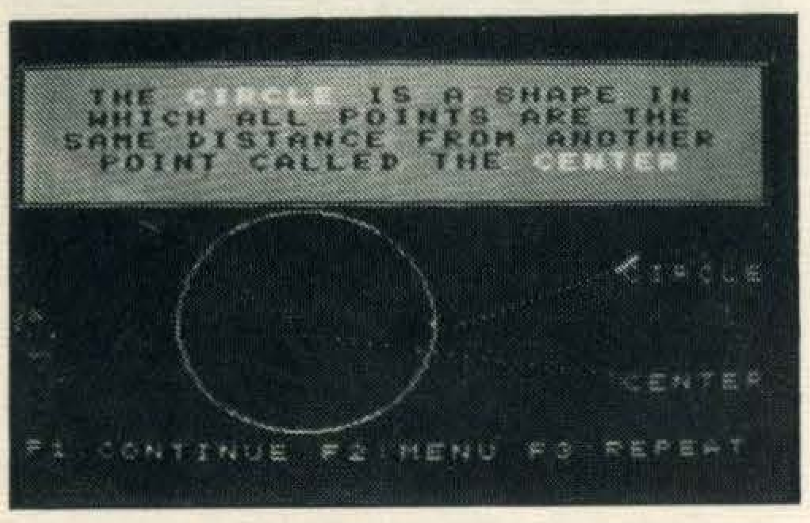
TITLE The Circle I

by Spectravideo

PRICE £6.95

TYPE Education

Spectravideo are launching a whole range of educational titles aimed at the eleven to fourteen age group. They come



from something called Mentor Educational Services Ltd. and are adapted from titles for the non-MSX Spectravideo computers.

The Circle I tackles the subject of — the circle. It opens with a reasonable title page showing an animated teacher and a blackboard. A disharmonious three chord tune plays until the space bar is pressed.

A student's name is then entered, up to nine characters long. Up comes a menu (white text on a blue screen) with eight options. Choose an option and away you go.

The aim of this program is to teach the terms associated with the circle, culminating in a four question text. Terms such as chord, radius, arc, pi and so on are all introduced.

The presentations are samey and not very interesting. Words appear in a yellow box while a small line draws out the educational diagram. When a display is finished, continue, repeat and menu options are presented.

The menu simply gets you to a different point in the program, rather than a new set of screens. Running through the whole program won't take more than an hour at the most.

The four questions vary little with each repeat of the program. They will also need a calculator to work out the problems — a pity as the program runs on a computer.

Circle I is a program that could do with a great deal of improvement — as educational software goes, it doesn't rate very highly.

2

TITLE Adventure Plus

by Premier Microsystems

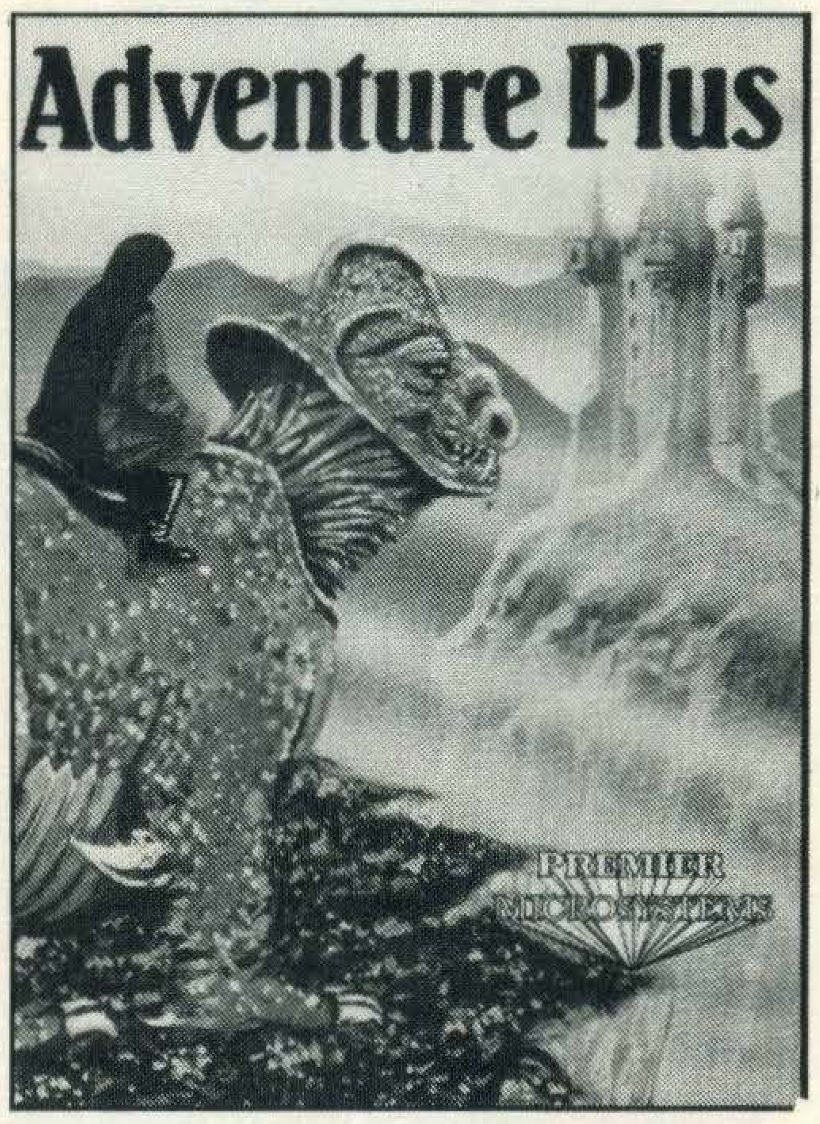
PRICE £7.95

TYPE Adventure game

Adventure games are those in which you play the role of the lead character, exploring strange regions in search of treasure. You type in your actions and the computer responds to them.

Some adventure games are incredibly sophisticated, requiring a great deal of running and patience to solve. This is not one of them. It is written in BASIC, has a limited vocabulary and very little to challenge the experienced adventurer. Novices may be amused, but only because they don't know better.

The scenario is a wood and a house. Objects to be collected are at the same points each



time you play the game and there is only a large dog to menace you. The major impediment to completing the game is that night falls and you are caught with nothing to light the way.

The goal is to find two caches of treasure. Reaching certain points, finding objects and so forth earns extra points, and you are given a rating at the end. There is a quit option, but no game-save facility.

Vocabulary is restricted. All too often a simple command is ignored. Some of the comments are amusing, but after the first time, hardly a giggle is raised.

Cheating is easy. Just LIST the program and you'll be able to read all the hints, locations and such like. If you keep a map, you'll not need to cheat in order to succeed.

As adventure games go, Adventure Plus is a minus game. Adventure game fans would do well to avoid it and wait until some real adventures are produced.

2

TITLE River Raid

by Activision

PRICE £11.99 (tape)

TYPE Arcade Game

Strap yourself in, put your finger to the fire button and take off for an all action arcade game. You are the pilot of a jet fighter, and your mission is to get as far up a heavily defended enemy river as you can, destroying as much as possible on the way.

The joystick moves you left or right, speeds you up or slows you down. Hit anything except a fuel dump and you're dead. You start with four jets, gaining an extra life for each 10,000 points you score.

Two people can play, taking turns at the joystick. There is a game pause facility, and River Raid goes into a demonstration mode at the start.

As you move up the screen, you reach bridges. Each bridge marks the end of a stage, and there are 60 stages to beat. You can start at any of four levels, so it is possible to avoid the easy stages.

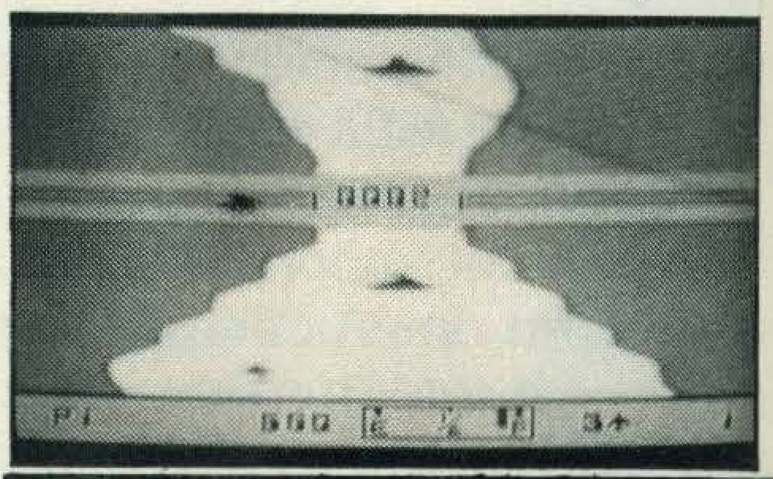
As the game progresses, more enemy objects appear. The river gets twistier, targets move and fire at you — in short, survival is difficult.

Fuel must be considered too. A gauge shows how much is left. Run out and you crash. You can top up your tanks by flying over a fuel dump, at slow speed for maximum effect. At higher levels, fuel dumps become increasingly scarce.

Graphics are good — bright, fast moving and varied. The sound consists of jets, firing and explosions — enough to wake the dead. There are also useful warning sounds to indicate low fuel.

Having fun at River Raid is easy. You'll be able to destroy plenty of helicopters, ships, bridges and so on before running out of lives. Then strategy becomes important. It all adds up to a very addictive game.

8



TITLE Pitfall II

by Activision

PRICE £11.99

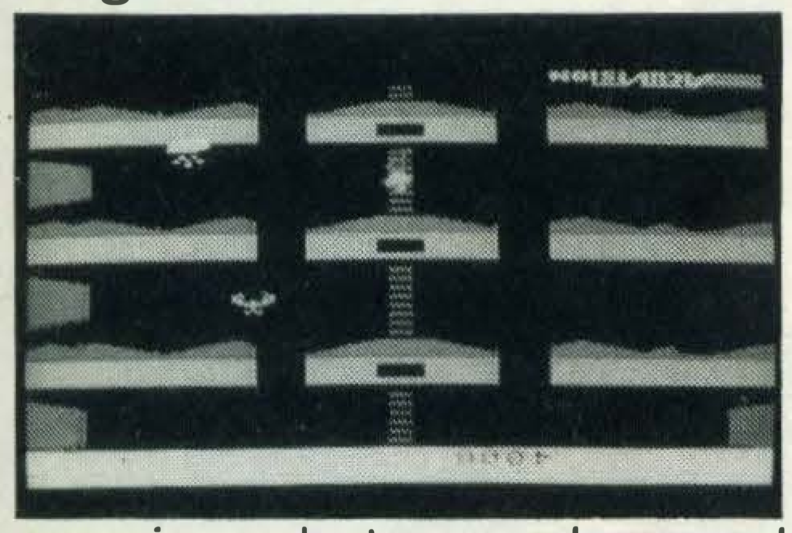
TYPE Arcade adventure

An arcade adventure combines the graphics and responsiveness of an arcade game with the scope and challenge of an

adventure game. This Activision arcade adventure is set in a complex set of over 240 chambers, deep under a Peruvian landscape.

You control Pitfall Harry, a searcher after treasure, trying to rescue lost companions Rhonda and Quickclaw. He has to negotiate platforms, underground rivers, ladders and other obstacles in the course of the game.

Of course there are plenty of things to avoid. Electric eels,



scorpions, bats, condors and frogs are all after him. The joystick moves Harry up, down, left, right or makes him jump. He can't fight back.

No time limit is imposed on the game—you play as long as you have points left. Mastering the whole maze will take many hours.

As you move through it, you amass points by collecting treasure. You will also come across red crosses. Pass over one of these and the next time you are killed you will be transported back to the last cross, rather than the beginning of the game.

The secret of Pitfall II is to get to know the caverns and how to avoid the various obstacles. The sheer size of the playing area means that this will take a long time. However, once you have learnt the basic skills, you should be able to get a good distance into the game. It is this sort of progress that makes Pitfall II very addictive.

Adventure arcade games for MSX are few in number, at the moment. Pitfall II sets a very high standard for others to try and emulate.

7

TITLE Decathalon
by Activision
PRICE £11.99 (tape)
TYPE Arcade Game

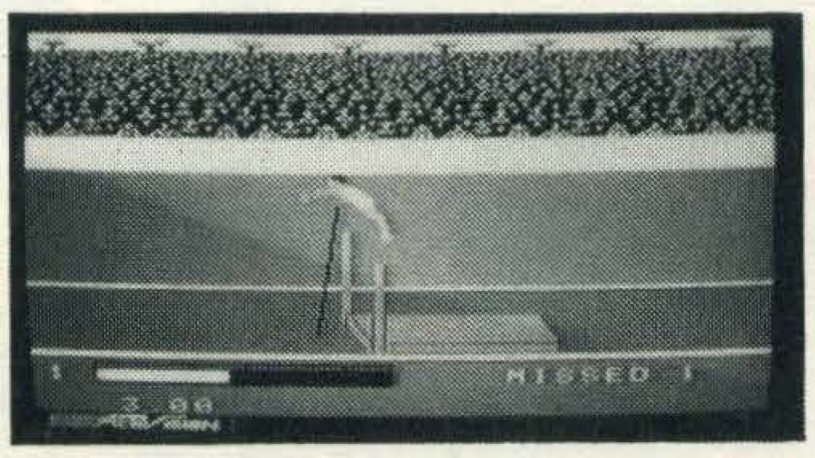
Here's your chance to emulate the feats of Daley Thompson, without putting on your running shoes. There are ten events to tackle, just as in the real decathlon.

In the game proper you attempt each event, trying to get as many points as possible. The events, in order, are the 100m sprint, long jump, shot putt, high jump, 400m, hurdles, discus, javelin, pole vault and a 1500m race to end. It is a gruelling competition.

Alternatively, you can train at any event, practising to master the techniques. There is a two player option too, for added competition.

The screen shows an athletic field, a static crowd and the track, runway, high jump or whatever. To run, waggle the joystick from left to right as fast as possible. A speed scale shows how fast you are going. To jump or throw, press the fire button.

Races are a matter of stamina and a strong wrist. The 1500m will really test you. Throwing and jumping events are more dependent on good timing.



Score a thousand points in any discipline and the crowd will cheer. 10,000 points or more is a championship score.

The graphics are realistic, though backgrounds are samey. Sound is used sparingly. The display is not critical — it is your performance that counts.

As a theme game, Decathalon succeeds well. There is a challenge, skill is involved, and it is a game the whole family will enjoy.

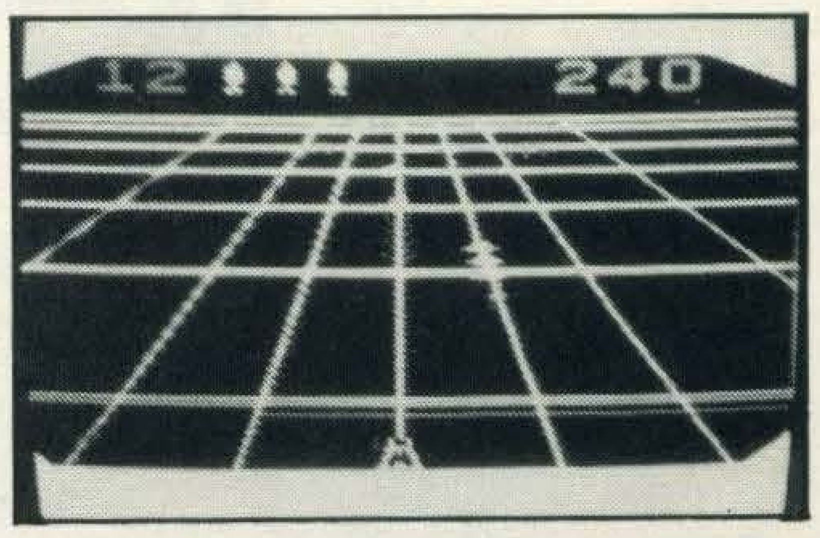
7

TITLE Beamrider
by Activision
PRICE £11.99 (tape)
TYPE Arcade Game

Once again it is you and your weapons against aliens. The setting is a grid of neon blue lines, based more than a little on the light bikes game from the movie Tron.

You move from side to side, firing down grid lines and avoiding enemy projectiles. Each phase ends when you have destroyed fifteen enemy saucers. You are then given a bonus mother ship to shoot at.

You have three lives at the start of the game. New lives are gained by colliding with 're-



juvenators'. Once you get the hang of the controls and the grid, staying alive in the early sectors is not that difficult.

The graphics are excellent — with fast movements, electric colours and a good range of pieces. Sound is used to good effect too, being of the zap/beep variety. There is a pause facility if you need to take a break.

There is an element of strategy needed to get really high scores. Mindless firing doesn't get the best results. Study the attack patterns, learn to control your vehicle and watch out for 'rejuvenators'.

Beamrider is not the only space shootout you'll want in your software library, but it is one that should get plenty of playing.

7

TITLE Fire Rescue
by Kuma
PRICE £7.95 (tape)
TYPE Arcade Game

You have to guide a fireman around platforms linked by ladders. Each platform has a mouse in distress, and your task is to grab the mouse, drag it to the end of the platform and throw it off. The mouse falls to the bottom of the screen, scurries along to an exit

The game starts with a practice level, before reaching the game proper. Here your task is complicated by living flames that will cremate you, given the chance. Fortunately each level of the building has a fire extinguisher.

Beyond the first level, there are fiercer flames, the platforms start to crumble beneath you and life gets very difficult. You have five lives, and will need every one.

The graphics are chunky, quite cute and accompanied by electronic noises. Keyboard or joystick control is possible.

An annoying feature is that you must complete the practice level each time you play the game.

Those after a slightly unusual game may find Fire Rescue attractive. We found it a little too much a matter of luck than skill, and it wouldn't be our first choice.

5

TITLE Dog Fighter
by Kuma
PRICE £6.95 (tape)
TYPE Arcade Game

Chocks away — here's an aerial dogfight to test your nerves. It is you against skies full of enemy fighters, and the more you shoot down, the more take off to avenge their deaths.

The screen shows your green fighter and the blue enemy biplanes, criss-crossing each other's tracks. To the left are the stage number, current score, high score, fuel and ammunition levels. There is also an altimeter.

To shoot down an enemy plane you must be at the same altitude. Dots on the altimeter scale will coincide. Push the fire button and, hopefully, your opponent will drop into the ocean with a watery splash.

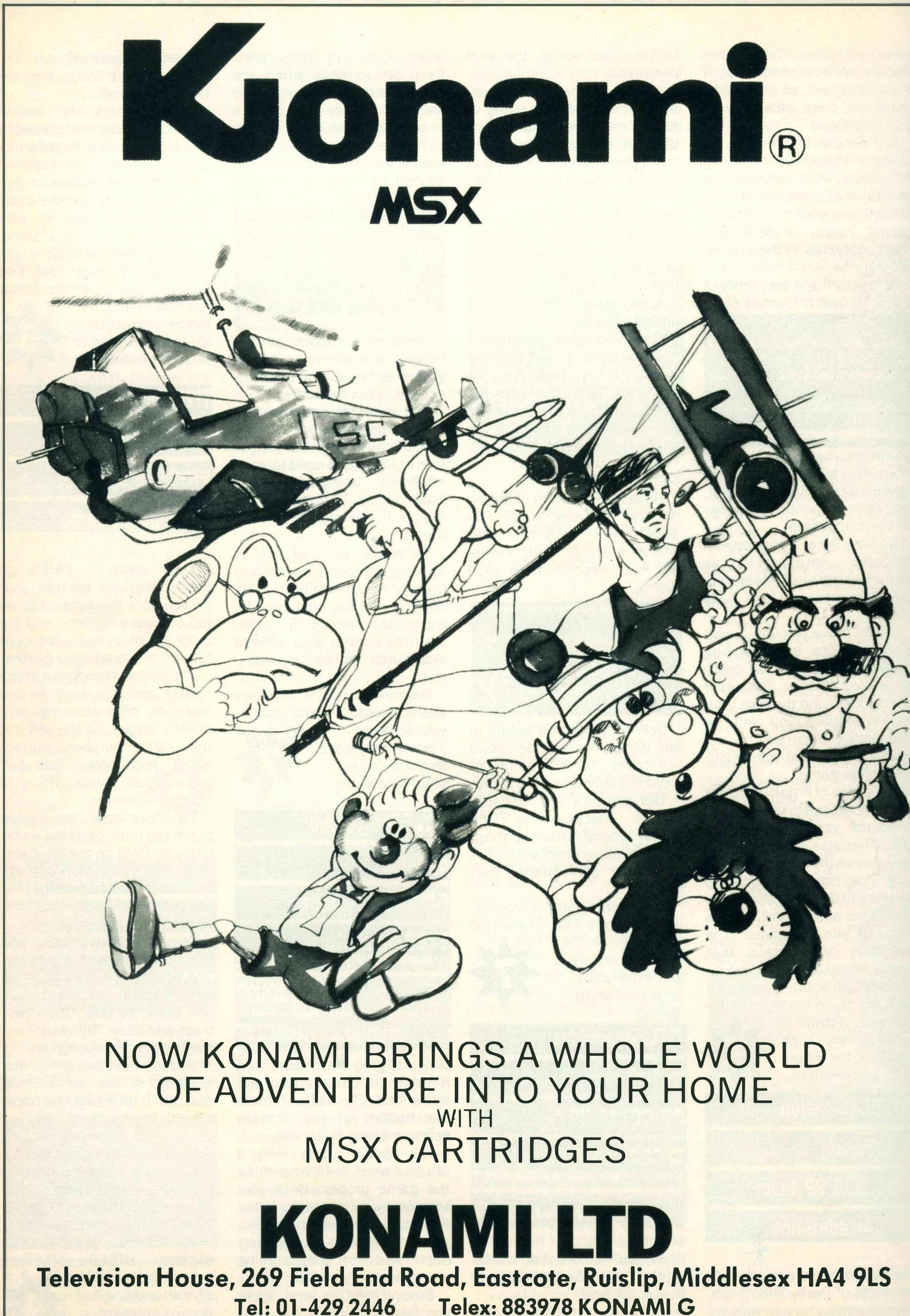
You have five planes, and they take off from a runway. The enemy operates from an aircraft carrier. At first there is one plane to beat, then two, three and so on. Things are not made easy for your fighter.

Scoring points is tricky. Just keeping in the air is hard enough. It took us some hours to get to the third wave of planes. Get the knack and Dog Fighter becomes great fun.

Graphics are minimally realistic, sound pretty basic. There are no on-screen instructions, and no variable levels.

For all that, it is not too expensive, will take some time to beat and should give all budding Red Barons a taste of glory.

4


Konami®
MSX
NOW KONAMI BRINGS A WHOLE WORLD OF ADVENTURE INTO YOUR HOME
WITH
MSX CARTRIDGES
KONAMI LTD
Television House, 269 Field End Road, Eastcote, Ruislip, Middlesex HA4 9LS
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KILL AN ALIEN – WIN A MICRO!

Want an MSX micro, without forking out the readies? We've got 20 to give away. Send in a postcard and you might end up winning



The micros are piling up at our offices. Help us to reduce the heap by entering this competition. If you win, we can't guarantee which machine you'll get, but we can guarantee it'll be a full-blown British spec, production model, unlike some of these

For the cost of a stamp, you could be the proud owner of a new MSX computer. We have 20 UK specification machines to give away, and one of them could be yours.

All we are asking you to do is to identify seven company names from the clues given, write the answers on the back of a postcard and send it to us. You'll find clues to the answers in the computer reviews. If you can read, you can win.

The prizes come from each of the seven manufacturers whose machines are reviewed in this issue. There is the superbly finished Sony Hit Bit, complete with built-in firmware. Canon's good looking V-20 is up for grabs, and there is a joystick thrown in. Spectravideo have their SVI-728 with two joysticks as part of the prize kitty. The 64K Mitsubishi ML-F80 is another prize, as is the stylish JVC HC-7GB, the colourful Toshiba HX-10 and the Sanyo MPC 100, with free software, could also be won.

Each of the seven manufacturers has been persuaded, cajoled or arm twisted into giving us some of their machines to give to you. There are twenty machines in total, one for each of twenty winners. The competition closes on Christmas Eve, 24th December, 1984. So, get your thinking caps on, read the reviews, answer the questions and you could end up with a 64K MSX computer being delivered as a late Christmas present.

TO ENTER

There are seven questions to answer. The answer to each one is the name of one of the companies offering you a prize. The reviews contain the answers, if you get stuck.

Write the answers, in order, on the back of a postcard. Send it to:

MSX Competition,
What MSX?,
38-42 Hampton Road,
Teddington,
Middlesex TW11 OJE.

All entries must reach us by last post of 24th December, 1984.

The prize draw will decide which computer is won by which entrant. A card for each computer will be picked at random, and the first correct entry drawn will win that computer. This procedure will be repeated until all prizes have been awarded. Unfortunately we can't guarantee that you will end up with the MSX machine you want most.

Anyone can enter the competition, but only one entry per person. We reckon these computers will be much sought after, and the chance of winning one can't be passed by.

RULES

1. Entries should be on a postcard clearly marked with the name and address of the entrant.

2. One of 20 64K MSX computers will be offered to the first 20 correct entries drawn after the closing date.

3. The judges' decision is final and no correspondence will be entered into.

4. The competition is not open to employees of Haymarket Publishing, their agents or suppliers, nor the employees of companies participating in the competition. No overseas entries can be accepted.

5. Entries must be addressed to MSX Competition, What MSX?, 38-42 Hampton Road, Teddington, Middlesex TW11 OJE by 24th December, 1984.

QUESTIONS

1. This company's MSX computer might be used to keep scores at a football match.

2. You might go loco over this company's computer.

3. This company's computer might have the nickname Victor.

4. Diamonds are a girl's best friend. This company might make three girls happy.

5. In 1997 this company's computers may be made in Chinese territory.

6. This company's computer is so simple, the cat could use it.

7. An accessory for this company's computer might produce a little light reading.

The new Mitsubis

For those in the know

Anyone conversant with home computers will know precisely why MSX was worth waiting for.

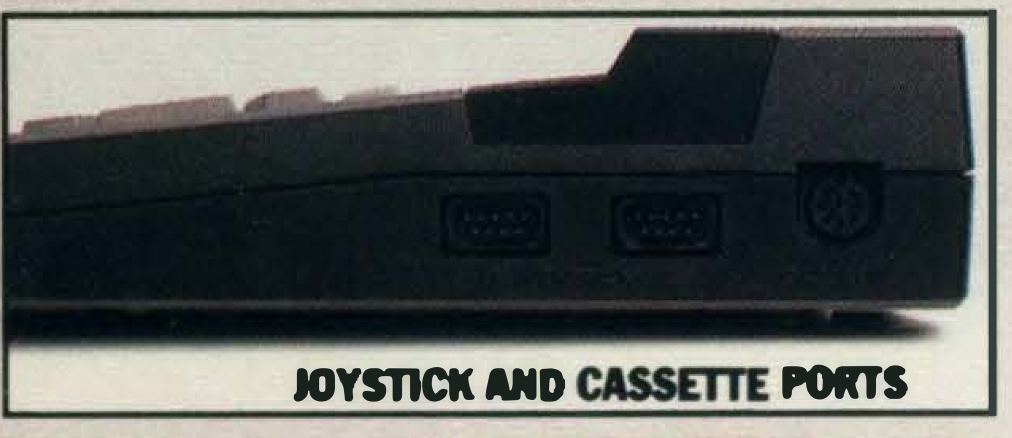
The sheer proliferation of computer and software systems flooding the market loudly underlined the need for a unified standard.

So the major companies jointly developed a single computer and software system. The result – MSX – the format that will be standard for all time.

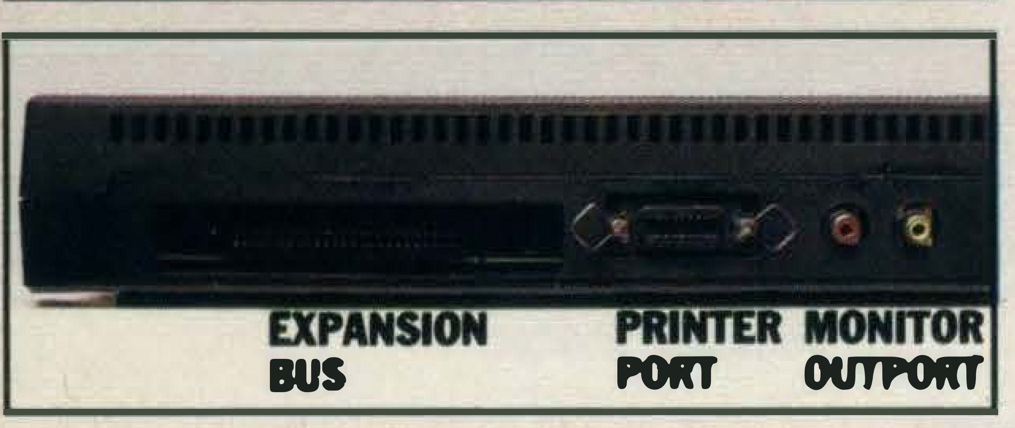
And those in the know will not be surprised that Mitsubishi are in the vanguard of the MSX movement. For, with the F-series, Mitsubishi offers everything that MSX is and more.

GRAPHICS

Maximum resolution of 256 x 192 pixels with all 16 colours available on the screen at the same time. 32 sprites in two sizes and two magnifications allowing easy creation of '3D' graphics. 255 pre-defined characters all of which can be used as straight text or easily mixed with graphics.



JOYSTICK AND CASSETTE PORTS



SOUND

Three independent channels which can be output through the TV loudspeakers at any volume, individually or simultaneously, at any of the available 8 octaves. All three channels can use the 'noise' generator for stunning sound effects.

KEYBOARD

73 moving keys, ergonomically designed for many hours of fatigue free use. Large cursor control keys which are excellent for both programme editing and game playing. 5 function keys giving 10 pre-defined functions which can easily be redefined from 'BASIC' using the 'KEY' command.

BASIC

MSX BASIC is possibly the most comprehensive version of the original language. There is a complete set of commands for creating graphics and sounds, manipulating text and moving sprites. In addition to this there are 'built-in' interrupt routines for detecting sprite collisions, function key selections and joy-stick fire buttons.

EXPANSION

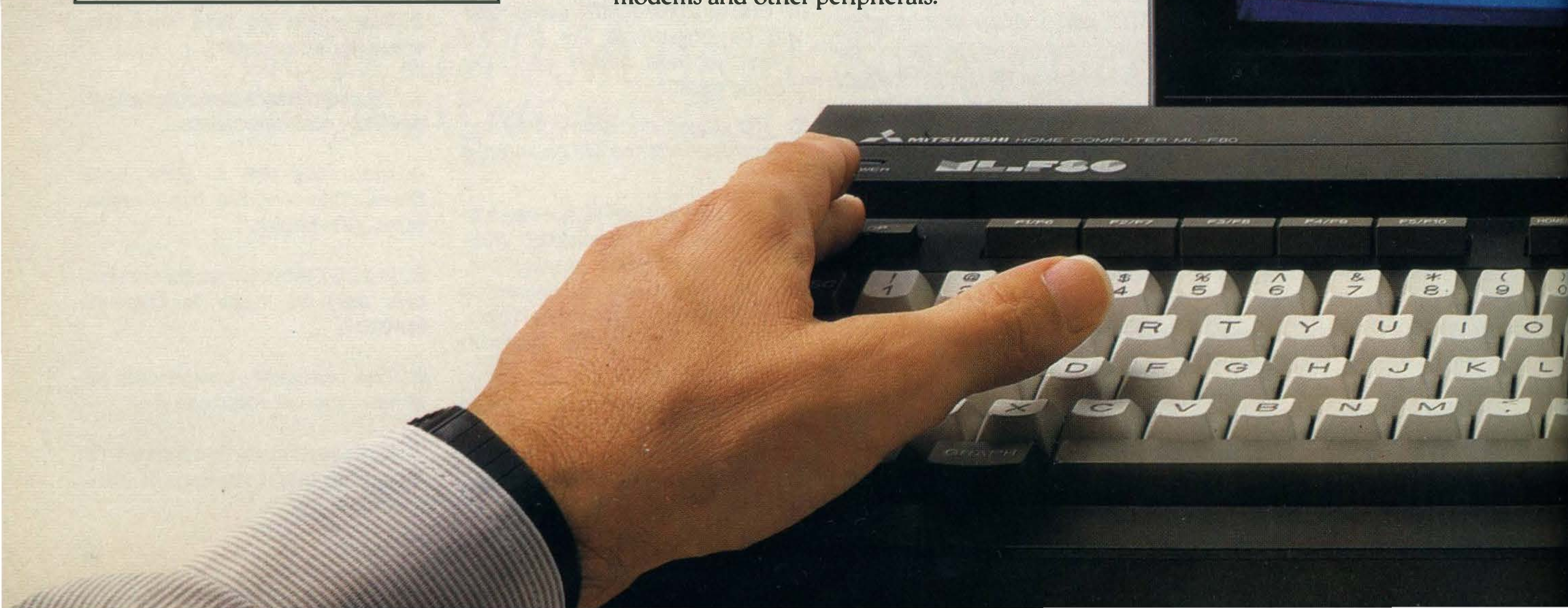
The Mitsubishi 64k ML-F80 and 32k ML-F48 are both equipped with 2 cartridge ports, 2 joy-stick ports and a centronics compatible parallel interface. It is through these devices that the MSX system can be expanded for use with disc-drives, printers, serial interfaces, modems and other peripherals.

SOFTWARE ON CASSETTE

The MSX system can load and save data onto cassette at 1200 or 2400 baud and unlike certain other home computers, the Mitsubishi F-series can be used with a normal domestic tape recorder for this purpose.

When you put all of these features together, with the knowledge that Mitsubishi is the largest manufacturer of Mainframe computers in Japan, those in the know will immediately recognise the true potential of the Mitsubishi F-series.





i MSX Computers

For those who aren't

The Mitsubishi MSX family computer is everything you wanted to know about computers, but didn't know who to ask.

It's friendly, it's fun and so simple, a grown man can use it. Yet so versatile even his computer-versed children would be hard-stretched to over-tax it.

It operates with any colour TV set. Just plug it in, and the full power of the computer is instantly at your fingertips.

FOR FATHER

The Mitsubishi MSX can do many things, from keeping a simple check on the bank balance to running a complete business with customer account files, stock control programmes and word processing. It is just as much at home keeping control of your record or stamp collection or playing 'strategy' games such as chess, othello or contract bridge.

FOR MOTHER

There is the opportunity to store recipes and other household information or keeping record of the children's progress at school. Household accounts can also be recorded so that savings can be planned for holidays and other seasonal expenses.

FOR THE CHILDREN

There is education, particularly computer education. In a world where computer literacy is now of foremost importance, MSX offers a broad base of educational software. With simple programmes for the very young through to complex programmes for older students like language learning.

Also, the graphics system of the Mitsubishi computer ensures that the MSX versions of your favourite games are reproduced with incredible speed and accuracy.

Undoubtedly, MSX is the format for the future, and will become the byword for computer education and entertainment.

And you can be secure in the knowledge that regardless of future developments, any investments made in MSX hardware, software and peripherals today will always be compatable with the Mitsubishi F-series.

So if you've waited until now to buy a computer, you couldn't have timed it more perfectly. Get to know one today.

MITSUBISHI COMPUTERS

Mitsubishi Electric (UK) Ltd., Hertford Place, Denham Way, Rickmansworth, Herts WD3 2BJ. Tel: 0923 770000.

SPECIFICATIONS

CPU:
Z80A (3.6 MHz)
Memory:
ROM: 32 KB
RAM: 64 KB (F80)
RAM: 32 KB (F48)
Video Ram: 16 KB
Screen Displays:
*Text Mode:
40 columns x24 lines
*Graphics:
256 x 192 pixels
Colours: 16
(15+transparent)
Sprites: 32
Output: RF, Composite Video
Keyboard:
73 moving-key keyboard
5 function keys
Cursor control keys
Special keys for screen editing
Sound:
8 octaves
3 channels for sound or 'noise'
Output by TV sound or External Audio Amplifier
Cassette Interface:
1200-2400 baud
Motor controlled by CPU
Parallel Interface:
Centronics
Joy-Stick:
2 x 9 pin connectors
Rom-Cartridge:
2 x 50 pin connector

*Subject to Scan of Monitor





AIMING FOR THE FIRST DIVISION?



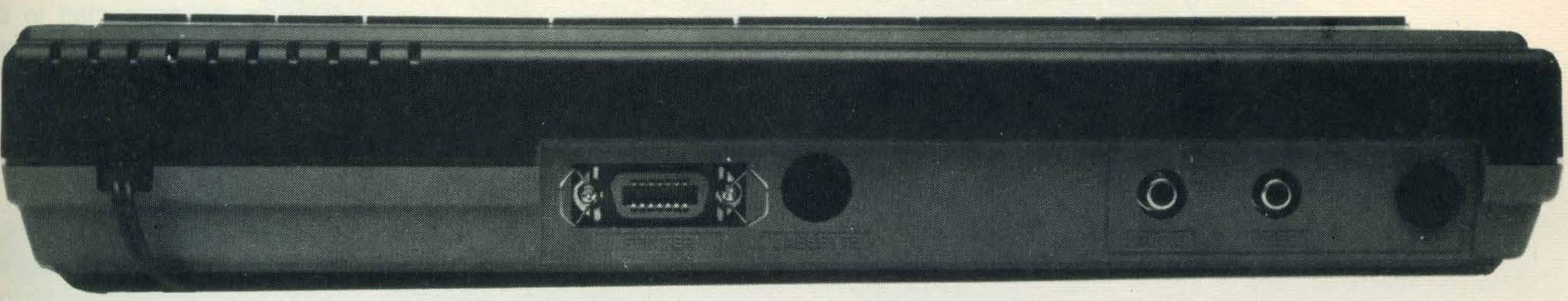
The £280 Canon V-20 is a stylish machine from a big league name. But will it score with the potential buyer?

There was a time when the name Canon meant gas cookers to most people (even though the brand name was spelt Cannon). Now Canon means cameras, photo copiers and the Football League. MSX computers can be added to that list too.

Canon is one of the most successful consumer companies to come out of Japan. Its beginnings were humble, its aspirations lofty. Never a company to miss out on an opportunity, it is one of the leading innovators in the photographic industry, has established an enviable reputation in the office equipment field and has been very active in sports sponsorship. The end result has been to make Canon very much a household name. When launching an MSX computer in a new market, that's a major advantage.

Canon isn't coming into the arena with all guns blazing. Its quota of machines from the parent factory is rather low, so a big advertising splash might be rather embarrassing. We'll have to wait until next year for the real force of Canon to make itself felt.

The company is pricing its machine at around £280. That's midway between the dearest and the least expensive computers. Canon is launching one 64K computer, cal-



led the V-20.

In line with many other manufacturers, Canon have redesigned their Japanese machine, as well as making it compatible with the UK PAL television system. It is being made available through outlets such as their photographic dealers.

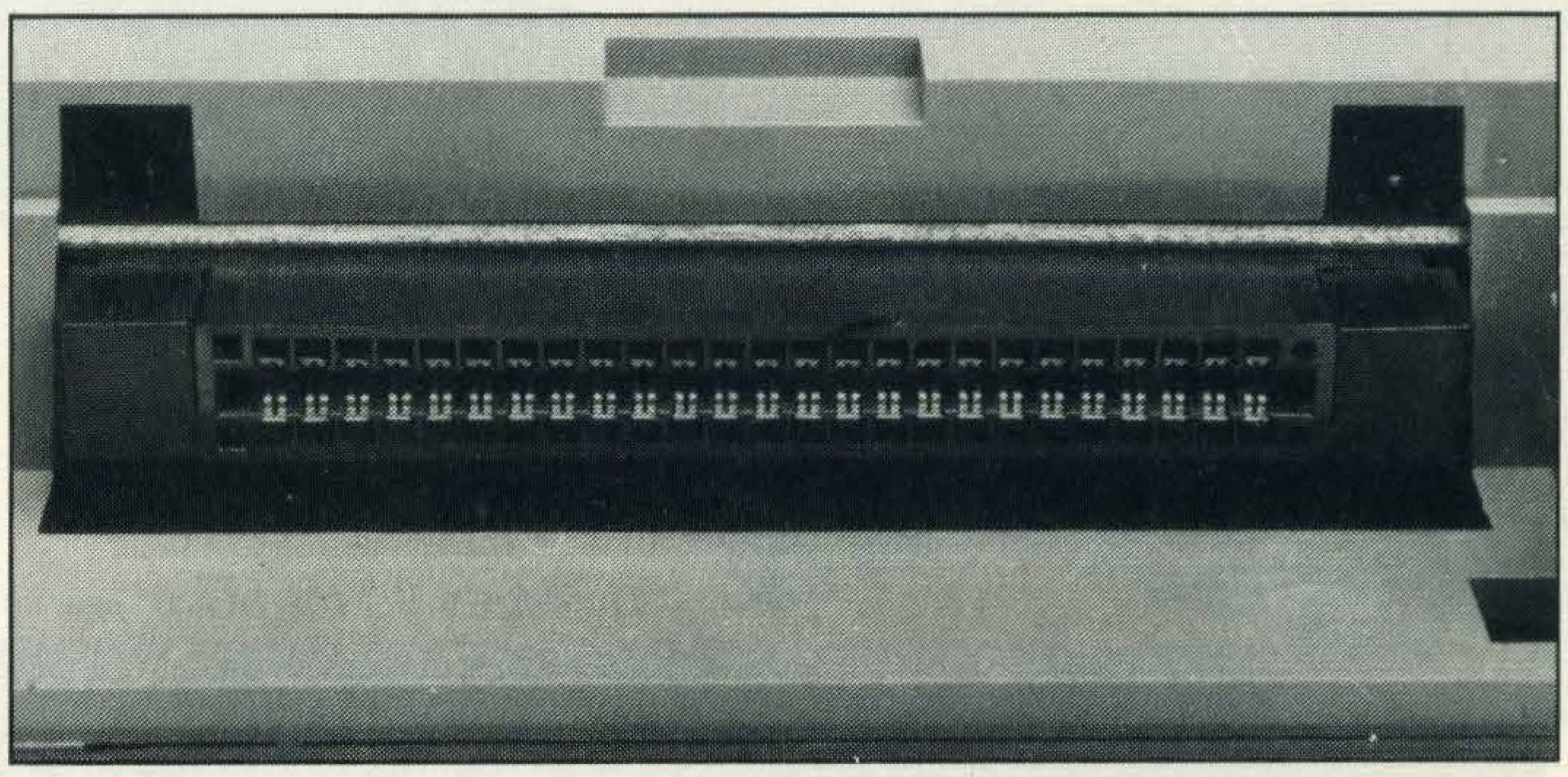
Visually, the V-20 looks chunky and friendly, if such a term can be applied to a switched on computer. Rounded corners, extra large cursor control keys, quietly confident orange and white lettering — and the reassuring Canon logo give this impression. It is a soft tech approach that distinguishes the Canon from the crowd.

'Visually, the V-20 looks chunky and friendly, if such a term can be applied'

There are no extra special features to this computer. The expansion port is unusual in that it is hidden behind a clip off panel at one end of the casing. The joystick ports are located on this front too, a slightly unusual location. Otherwise the Canon is a bog standard 64K MSX computer.

Touch it and some of the initial euphoria dies away. It has a plasticy feel that is a little too obvious. The beauty turns out to be little more than skin deep, and when compared to the superb finishes of machines such as the Sony, that is a handicap.

The keyboard is equipped with a full complement of alphanumeric and control keys, including a key for European accents. The alphanumeric and cursor control pads are in dark grey, control keys in pale grey or black. The keys are very slightly concave and have markings printed on them, rather than engraved in their surface. With heavy use, markings may start to be worn





The Canon's rear 50 pin expansion slot is protected by a removeable cover (above). An unusual location for the two ports — in front of the keyboard.

off the keyboard.

The keyboard is angled ever so slightly — far from enough for a typist to feel really at home with a word processing program. The home user will manage quite comfortably but compared to keyboards on some of the other MSX machines, the Canon's is not first division.

Cursor control keys are a delight. They are huge by comparison to any others, have a positive click to them and are so arranged that they can be used very rapidly indeed. Who needs a joystick even for Track and Field? They make the Canon a prime choice if playing games is your main interest.

The other control keys are clearly marked and arranged around the alphanumeric keys in the usual places. The space bar is a little on the short side, The RETURN key could do with being bigger, but if you are used to typewriters of the electronic sort, you'll have no problem with the control keys. There's a green CAPS light, an apparently standard feature on MSX computers.

The function keys are arranged in a row along the top of the keyboard, flanked by **STOP, INS, DEL** and **HOME/CLS** keys. They are large, black and easily found by roving fingers. The non-function keys are smaller but serrated. A strip above the keys denotes their functions. If only the keys had their functions on them, they'd be truly excellent. As it is, they are fine. Pressing CRTL and STOP together, with one hand, is an easy task.

Keyboard conclusions are thus twofold. The alphanumeric keys are par for the course but could do with improvement. The control keys are among the best we have seen on the launch models.

The only other control on the Canon is an on/off switch to the right hand end. A power on light glows green when the computer is switched on. There is no reset button — a feature found on some of the other MSX machines.

The Canon is equipped with all the usual interfaces, for maximum compatibility.

Behind the keyboard is a single cartridge slot, protected by a sprung flap. Cartridge software or expansion accessories slot in here quite easily.

Joysticks fit the two ports at the front of the computer. They are labelled one and two. The forward location is handy as you don't have to turn the machine on its side or back to fit joysticks. We had the opportunity to try the Canon VJ-100 joystick too.

There are only five ports on the back of the V-20. From left

'The forward location is handy as you don't have to turn the machine on its side to fit joysticks'

to right these are television, video, audio, cassette and printer. At the far end of the casing is a permanently attached power cable.

The Centronics printer interface has two wire cable locks. The cassette socket is standard eight pin DIN. All the sockets are well shrouded against dust and their functions clearly marked.

To find the 50 pin expansion port a plastic panel must be removed from the side of the V-20. It snaps off easily to reveal a second cartridge port. The panel offers good protection against nasties, though it may get lost. Companies such as JVC also have an expansion



port on the side of their computers, but protected with a sprung flap. Canon's protection seems a little like an afterthought.

The expansion port is for cartridges or peripherals with cartridge type end blocks. Fitting an accessory such as the Spectravideo disk drive is not possible, without modification to plug or socket.

The two conflicting means of making the expansion port may cause confusion in the initial months of MSX. The older system, supported by Spectravideo, Sanyo, Toshiba and others has the advantage of more being able to fit it. However most of the peripheral makers in Japan are keen to adopt the newer cartridge edge-connector.

This new connector will fit both the cartridge and the

Interface

expansion port. The MSX standard specifies only one such 50 line port, so this approach would easily enable budget machines to be built. The older connector offers more versatility at the moment. The ideal solution would be for some enterprising accessory manufacturer to make a converter so that peripherals can be connected to either interface.

Anyway, Canon have opted for two cartridge ports. Software cartridges could be connected to the side socket as well as the one on the top of the computer.

At present Canon have few peripheral plans that will make the world sit up and take notice. They make a range of quality printers and these are already well established in the home and business computer markets. These printers all use the parallel Centronics interface, so can be connected to the Canon or any other MSX computer. There will be no printer designed, cosmetically or functionally, specifically for the V-20 until next year.

The joystick, priced at £20, is in racing green and off-white. It is identical to the joysticks we have seen from JVC, Toshiba, Sanyo and other computer companies. One Japanese

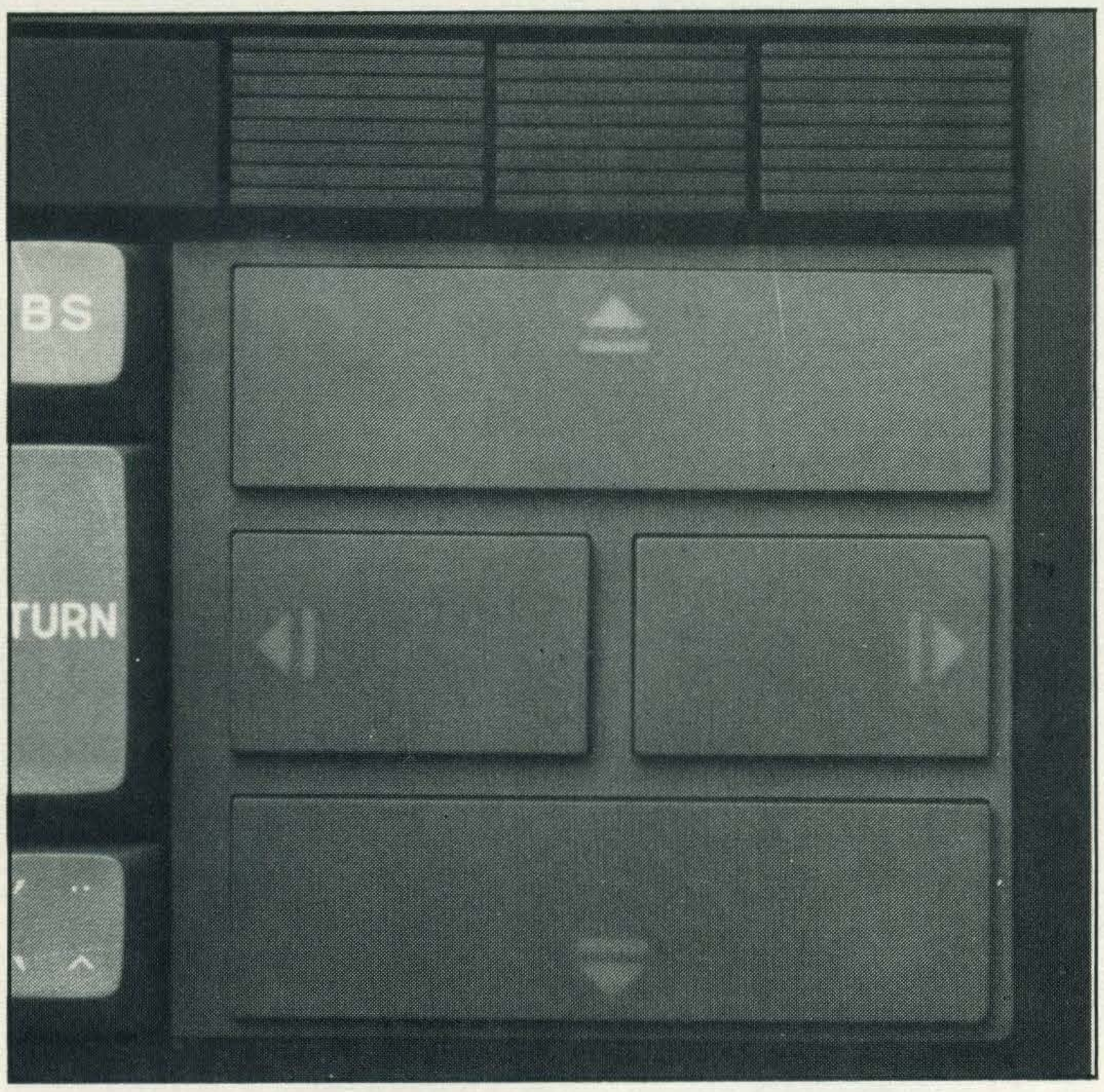
'Some games players prefer loose joysticks to stiffer versions — It's a matter of personal choice'

joystick manufacturer must be making a very tidy sum out of the MSX boom.

The joystick has two fire buttons, one atop the stick, and four suction cups to hold it to a desk. It moves in eight directions and has a very slack feel to it. Some games players prefer loose joysticks to stiffer versions — it's a matter of personal choice. The Canon model works as all the other identical ones we've seen and is reasonable value for money. If it was styled to match the UK standard V-20 computer, instead of being in white and green it would be better.

Next year we should also see a graphics tablet that is MSX compatible and bears the Canon name. No further details on that are available at the moment.

The Canon's performance is



Canon's £433 colour printer (top) makes a very attractive accessory. The huge cursor keys (above) are a boon, but the keyboard overall (below) doesn't live up to its good looks.





The top row of cursor keys can be difficult to spot in a hurry.

more than up to scratch. The colours aren't quite as vivid as those on the Sanyo, but did justice to all our games. The sound is clear too.

As for heating, the built-in transformer gives off very little heat, even after prolonged usage. There aren't that many grilles, so Canon's designers have pulled off rather a neat trick in keeping the machine running cool.

Canon supply few extras with the V-20. There is a 30 page user guide, a 300 page reference manual, TV and cassette leads. No software comes with the computer.

The user guide is clear, concise and just what the beginner needs. It explains the parts of the computer, how to set it up and how to connect it to a television. Then it moves on to a description of the keyboard in its different modes and a guide to editing programs using the screen editor.

Next is a simple introduction to the BASIC language — how to enter lines, RUN a program and so on. Chapters on the connection and use of cassette recorders, cartridges and joysticks follow, and the guide ends up with a useful collection of information on memory structure, interfacing and so forth. There is enough information to ensure that you are able to use your Canon computer without resorting to other references or manuals.

LIKES

Appearance

Choice of add-ons

Choice of video outputs

We haven't seen the reference guide, but it is described as a guide to the BASIC language. If it is up to the standard of the user guide, Canon owners will be among the most literate of MSX owners.

As for the ommission of software, the lower than usual price of the V-20 makes up for that. With the money you've saved you'll be able to buy the software you want, not have to put up with what the computer maker thinks you'd like.

That, then, is the Canon V-20 MSX micro computer. It is a machine about which few negative things can be said.

DISLIKES

Short key travel

Sound

Finish

At the price, it offers better value for money than the Sanyo, Sony and Mitsubishi computers, if you don't mind not getting software with the computer. It is not the cheapest machine around, being undercut by Toshiba and Spectravideo, and it won't be that widely available.

Should you decide to buy the Canon, you'll be getting a very fair MSX computer. The good documentation should ensure that you have few problems using it and the MSX standard means you have a good BASIC to work with.

Compared to the dearer machines, the finish of the Canon leaves a little to be desired. An extra £20 spent on the Hit Bit will get you a better finish, plus some useful built-in software.

CANON V-20 £280

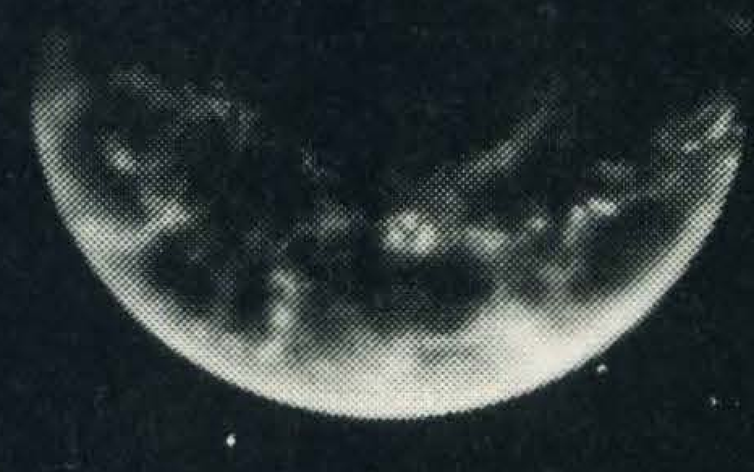
SPECIFICATION

CPU	Z-80A equivalent (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K expandable to 96K includes 32K MSX BASIC
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	48 alphanumeric, 25 control keys, Standard key cursor control
NUMERIC KEYPAD	No
VIDEO DISPLAY	
TEXT	40 characters × 24 lines
GRAPHICS	Maximum resolution 256×192 pixel
COLOURS	16
SPRITES	32 independently programmable
OUTPUT	TV, Monitor
SOUND	
GENERATOR	3 channels with 8 octave range
OUTPUTS	Mono audio output (RCA phono) 150mV/10kOhm standard
INTERFACES	
JOYSTICKS	2 Atari standard
EXPANSION BUS	No
CARTRIDGE PORT	2
PRINTER	1 × Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	No
DIMENSIONS	397×218×60mm (W×D×H)
WEIGHT	2.4kg
POWER SUPPLY	Built-in transformer
FINISH	Matt black plastic case, grey/pale grey keys, white lettering
SOFTWARE SUPPLIED	None
SUPPLIED ACCESSORIES	1 video cable, 1 audio cable, Instruction manuals
DISTRIBUTOR	Canon (UK) Ltd, Waddon House, Stafford Rd, Croydon CR9 4DD Tel: 01-680 7700

Verdict

Canon's name and reputation should sell the V-20, regardless of the competition. No doubt once they get into volume production for export markets, they will put their marketing muscle to work, trying to steamroller the opposition. Until then, if you see the Canon and like the look of it, it's a good buy. If you shop around and evaluate the opposition you might just be swayed into spending a little more. Canon's effort isn't a world beater, but it does a more than adequate job. The cursor keys are excellent, and even if the finish doesn't quite match the flair, it looks good.





STEPPING OUT IN STYLE—SOUND AND VISION

JVC HC-7
£279.00



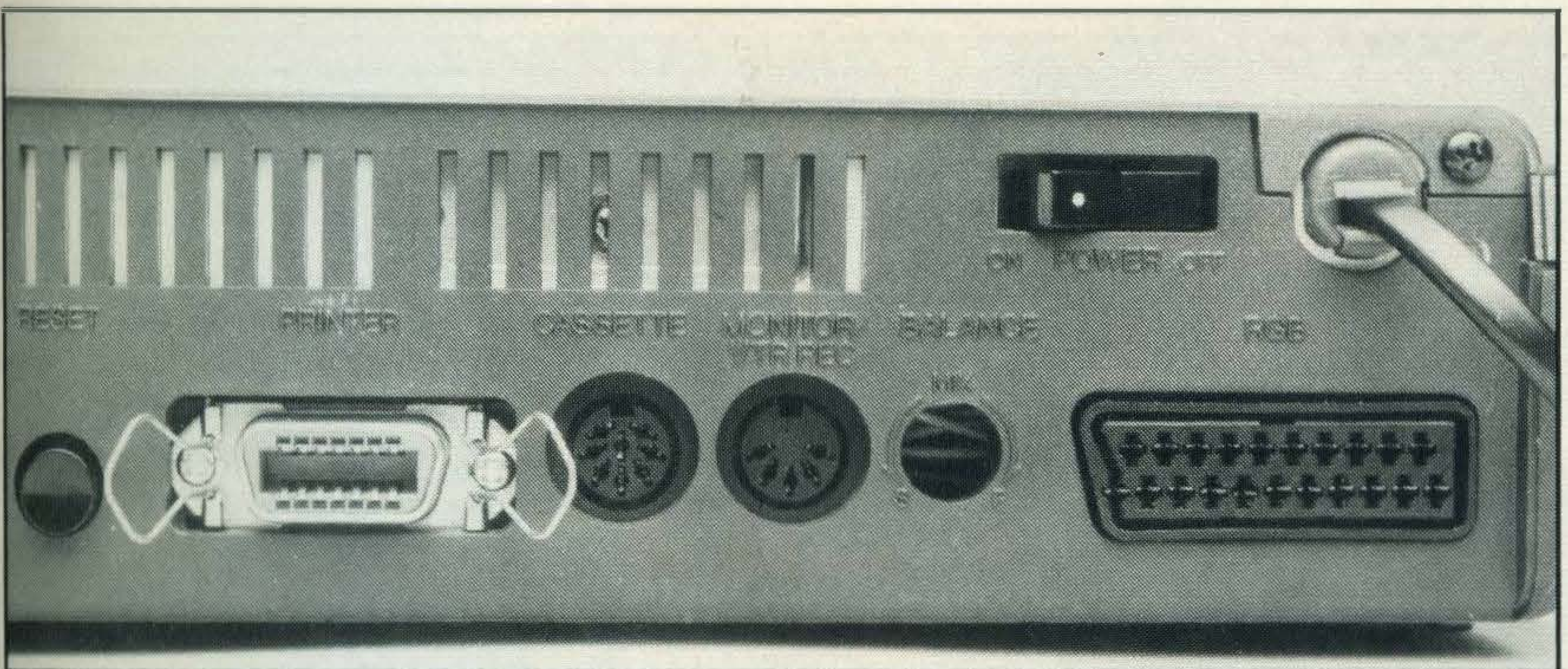
JVC's £279 HC-7 is stylish and at the heart of a system of music and video peripherals

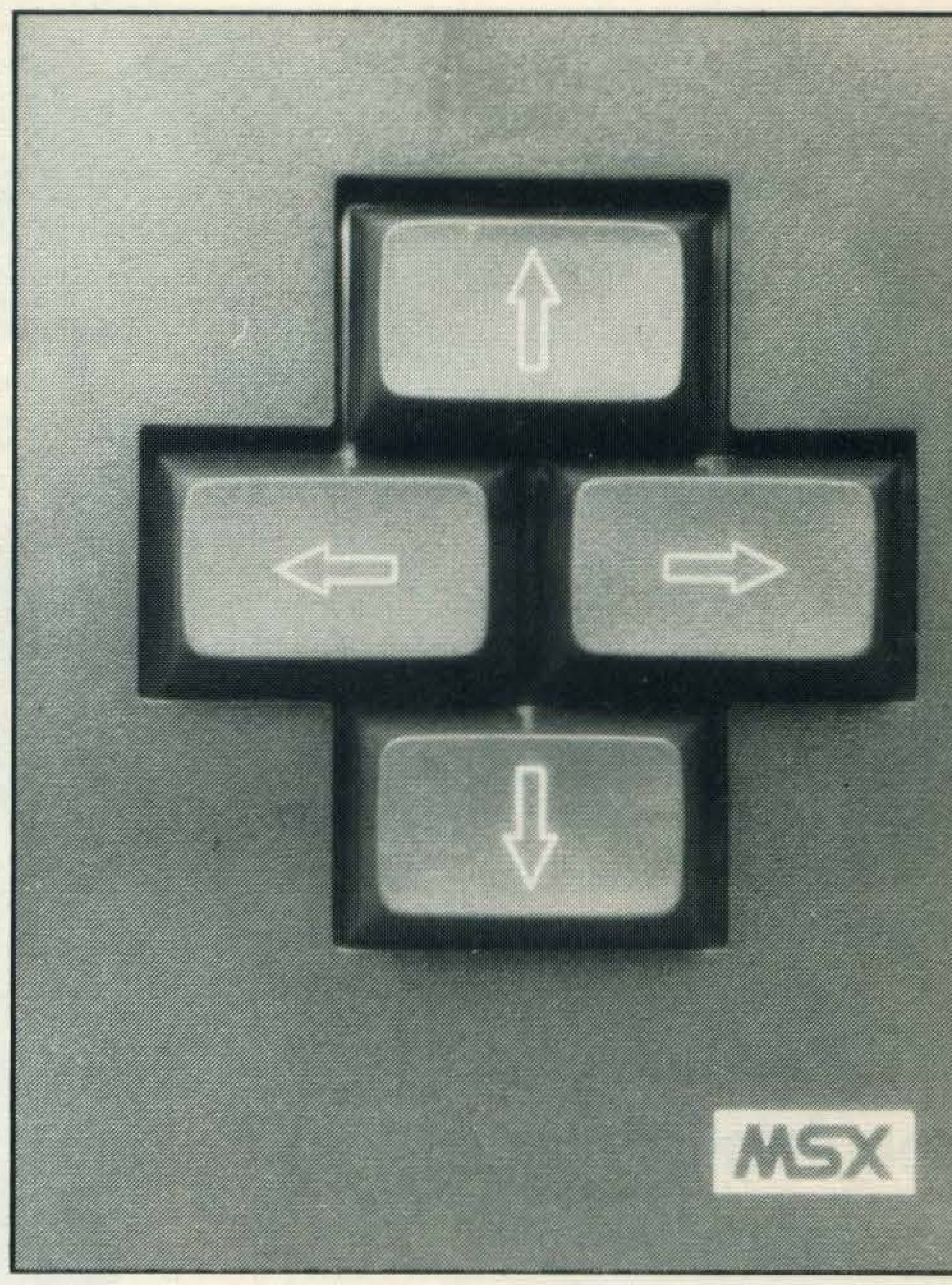
The JVC HC-7 MSX microcomputer is certainly good looking. You are probably familiar with the high-tech, slick appearance of JVC video recorders, TVs and hi-fis — think back to the last time you wandered around the TV and audio department in your local department store. Well, the company has extended this policy into a new field — microcomputers.

Looking at the micro itself, together with the first batch of JVC peripherals to be released — a data recorder and joystick — it is arguable that this is some of the most stylish gear currently being offered to the home micro user.

But it is also arguable that in order to compete with sub-£200 micros like the Commodores and Sinclairs of this world, the £279 JVC needs to look good as well as have a superior specification.

The case has a metallic grey finish, with an extra, raised section behind the keyboard leaving plenty of room for the internal power supply. This means that you have the convenience of an internal power supply — no extra spaghetti and fewer connections to come loose — with the provision by means of air grilles for plenty of





room to let air circulate and keep the transformer reasonably cool.

Alphanumeric keys are off-white with black lettering; the control keys are dark grey with off-white lettering. The whole keyboard area is in the same dark grey as the control keys.

Five separate function keys sit in a row above the main keyboard and are large enough to be found quickly and easily when needed. Each key has two functions, the second set being accessed by means of pressing the shift key.

The entire keyboard is sculptured quite steeply which is ideal for the touch typists

'The user has access to the majority of printers now available on the UK market'

among us who can, for instance, more easily reach the backspace key. But this ease of use is spoiled to some extent by the short key travel which eventually becomes uncomfortably jarring on the fingers.

The sloping keyboard could, however, be a bit of a problem for the majority of home computer users who tend to be typists of the 'hunt and peck' two finger variety.

Some similarly accomplished typists in the MSX office found that during a quick burst of typing, they were hitting the top row of keys at an awkward angle, or hitting the wrong keys altogether.

The separate cursor control keypad is a great improvement over the more modest provision on most home microcomputers for screen cursor movement. The four keys are large and clearly marked, but do have the same short key travel characteristics as the main alpha keyboard.

The back of the HC-7GB reveals a generous array of interfaces to link up with the promised range of MSX-compatible peripherals. Because several industry standard connections have been included here — not on all MSX micros — the user has a very wide choice of add-ons indeed.

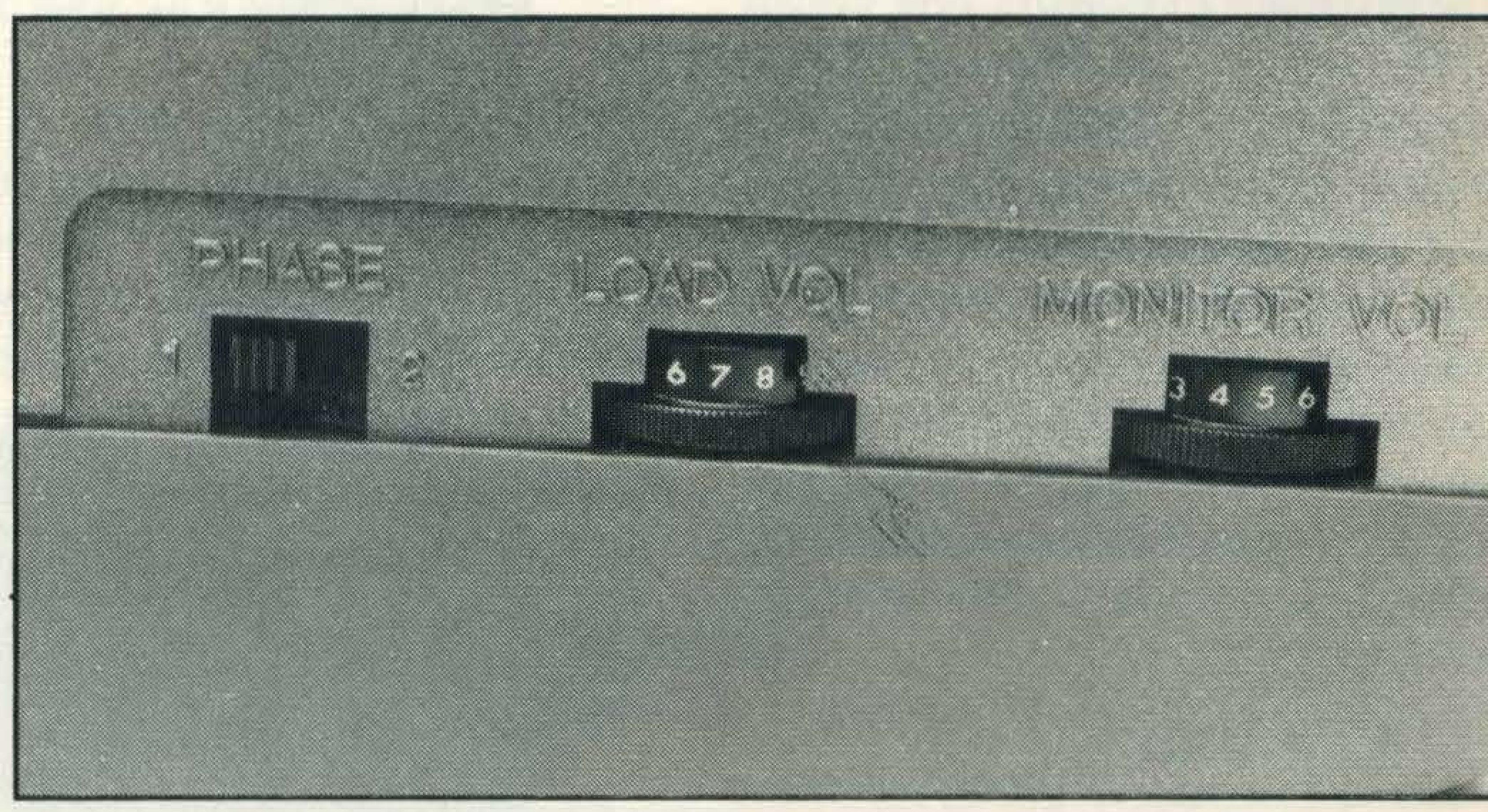
Looking at the rear of the machine, from left to right, we have two cartridge slots (one around the side of the machine), an RF output, reset button, printer interface, cassette interface, composite video/audio output, an ON/OFF switch and the unusual RGB video monitor output.

The two cartridge slots, which can be found on each side of the back right hand corner, each have 50 pins and will allow you to connect the micro to games cartridges, ROM cartridges and an RS232 module which should be released at the same time as the machine itself.

Each slot is provided with a spring loaded flap which should protect the delicate pins from any dust and prying young fingers that may be lurking around.

Above the cartridge slot on the rear surface of the box, is the RF output for connecting up an ordinary domestic colour television receiver.

RGB port and a reset button, above. Cursor keypad, right, is excellent. Data recorder controls, below, are comprehensive



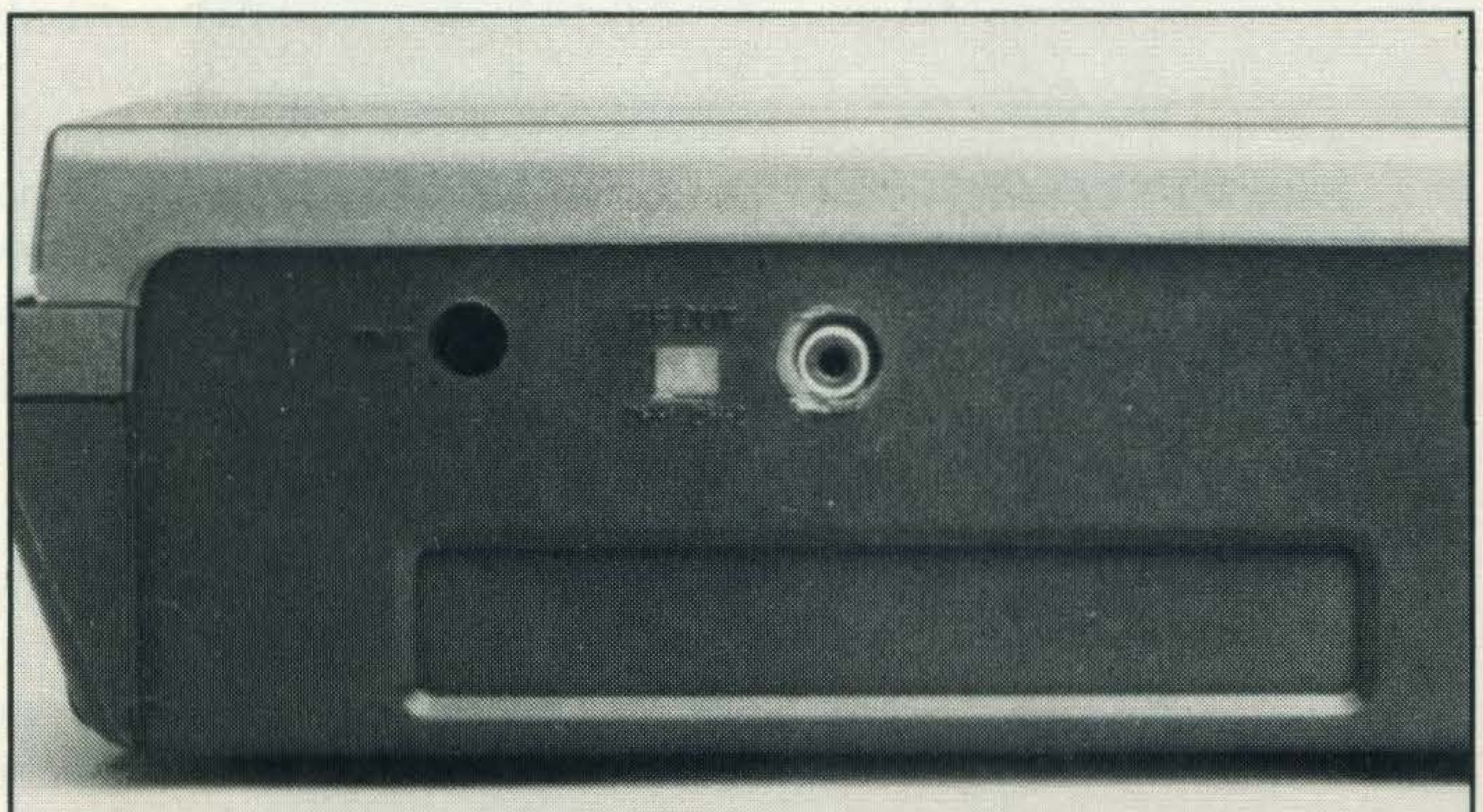
Next on the right is the reset key, a welcome but all too frequently absent feature on home computers. Our only complaint is that it would have been easier to locate on the side of the machine than the back, where you have to fumble unsighted among all the slots and buttons before you can put your finger on it.

The printer interface is Centronics standard, to comply with the MSX specification. This means that the user has access to the majority of printers now available from the very cheap to the really very expensive.

Moving on past the cassette interface are facilities for connection to a dedicated colour monitor. You have the choice of a composite video/audio output or next to it an RGB output, which is extra to the MSX specification, and won't be found as standard on many other MSX micros.

Above the RGB is the on/off rocker switch, which is quite easy to reach. Finally, on the left hand side of the micro are two 9-pin I/O ports which can take Atari standard joysticks.

With the machine up and running there were one or two minor niggles. The most noticeable problem was the sound, which was feeble, to say the least. Although the volume is controlled by the volume knob on the television, we could only produce a very muted noise, even with the TV volume turned right up.



Second cartridge port is covered to prevent dust entering the innards

When we asked JVC about this they assured us that it was merely due to the fact that we were testing a prototype machine with a reduced audio output voltage — not the actual model which will be available in the shops. Looking inside the casing, it was immediately obvious that this was not the finished product that will appear in the shops.

Although the case itself was the finished cosmetic version, the guts of the machine were merely a quickly cobbled together confusion, put together in Japan and flown

'JVC plans to sell a much more detailed manual separately from the machine'

over here for review and demonstration purposes. JVC pointed out to us that as the machine is built in its huge TV manufacturing plant, if they can't get the sound and TV connections right, nobody could. Hopefully there will be no problems with the final product.

Another problem is that one of the green LED indicators on the keyboard wasn't working on the review model — the one next to the CODE key, to be precise. We assume that on the Japanese model it was used to indicate that the Kana keyboard was in use.

JVC assures us that it will







Keyboard looks classy, is nicely angled and has sculpted keys

JVC's joystick is the same as many from other makers, and has a light action

HC-R105 Data Recorder is rather pricey but has many features and is a classy peripheral

definitely work on UK models, and will indicate use of either the CODE key or the unmarked 'dead' key, which stops movement of the cursor to place accents above letters.

As yet, no documentation is available, but a spokesman told us that two booklets will be supplied in the box with the machine. One will be a simple instruction leaflet, just showing how to set up the system and load cassette based software, for instance.

The other booklet will be the full manual, with about 90 pages introducing the reader to programming the MSX. It looks likely this will be a 'corrected' version of the Japanese manual.

On the subject of documentation, JVC plans to sell a much more detailed manual separately from the machine. It will cost in the region of £20, be written by Microsoft, and carry the JVC logo. It will be 'the ultimate reference work on

'With the machine up and running there were minor niggles'

MSX' according to the company, but it wouldn't be surprising if some, if not all the other manufacturers, sell it too—so there's a chance you could pick it up for something a little cheaper than £20.

Along with the documentation, JVC is supplying the RF cable to connect the micro up to your TV set's aerial plug, and the cassette cable so you can load cassette-based software. As for a demonstration cassette, a spokesman couldn't say whether one would be included or not. A demo tape is under development, though, which

would include an introduction to programming plus a few games. So let's hope it is included in the purchase price.

Several JVC peripherals will be available, or are planned to be available, in the near future.

The data recorder, which will cost £89, must be one of the most expensive cassette recorders dedicated to home microcomputer use. But if it's style you are after, this is the one to buy.

The whole unit comes in the

LIKES

Appearance

Choice of add-ons

Choice of video outputs

same metallic grey as the HC-7GB micro with large microswitches and a damped cassette eject system.

It looks as though it should belong to a hi-fi system rather than a home computer system — what with its flashing lights, micro-switch keys and oil dampened cassette eject system. But, after all, what you pay for this could buy you a stereo cassette deck.

Special 'computer' facilities — all those little bits which your average data recorder doesn't have — are included as standard here. For instance, you get a mic switch which lets you add comments to each program on the tape, a high speed loading facility and a program search function.

Perhaps the most interesting add-on to come from JVC will be the MIDI interface which it plans to make available in January or February next year.

The interface itself will be supplied as a cartridge to fit into one of the JVC's interface slots, and will provide the means for the musically minded to link their system up to a musical keyboard with MIDI output. This means that the JVC can be used as a sort of composer, storing and manipulating sequences of notes.

JVC will soon be supplying the keyboard to go with the interface — which will be called the KB600 and will cost £629. Strangely, the keyboard will be available three months or so before the interface — there must be a reason there somewhere.

The keyboard is capable of stand alone use, though, unlike Yamaha's new system which relies on the computer for its operation.

As well as the four-octave keyboard, the JVC KB600 includes built-in stereo speakers and a digital sequencer for 128 notes — which can be extended to 300 notes by means of another accessory. The whole system provides you with 56 stereo rhythm variations and 16 percussion instruments with which to create your music.

As well as a joystick for £12.95, JVC will be supplying an RS-232 interface which will

DISLIKES

Short key travel

Sound

plug into one of the cartridge slots and let you connect up your system to the outside world through modems, acoustic couplers and other communications devices. JVC tells us that the RS232 board will be available before Christmas, but no prices are available as yet.

January should see the arrival of JVC's 3½ inch floppy disc drive, which will take single-sided, single-density discs with 500K of unformatted storage. The drive will come complete with adaptor, and software will be ROM based. Again, no prices are available so far.



If looks could kill, the HC-7 would be a lethal computer. The designers have earned their wages

Verdict

So how well will the JVC home micro sell? For a start, the HC-7GB comes from a huge electronics corporation, now a household hame. Buyers of the machine know that the company is extremely unlikely to go bust — which is more than — could be said for other computer manufacturers both at home and abroad in the past.

JVC intends to make its micro available through already well-established outlets — namely independent dealers, High St multiples and large, well-known department stores. JVC offer style and support plus a 'branded' expansion into music and video accessories.

JVC HC-7 £279

SPECIFICATION

CPU	Z80A (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K includes MSX BASIC
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	49 alphanumeric 24 Control keys
NUMERIC KEYPAD	Yes
VIDEO DISPLAY	
TEXT	40 characters × 24 lines
GRAPHICS	Maximum resolution 256×192 pixel
COLOURS	16
SPRITES	32
OUTPUT	21-pin RGB, 5-pin DIN (Composite video & audio) RF (phono)
SOUND	
GENERATOR	3 channels with 8 octaves
OUTPUTS	Mono audio output (RCA phono) 150mV/10kOhm standard
INTERFACES	
JOYSTICKS	2 Atari Standard

EXPANSION BUS	—
CARTRIDGE PORT	2
PRINTER	1 × Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	Yes
DIMENSIONS	382×286×87.5mm (W×D×H)
WEIGHT	2.8kg
POWER SUPPLY	Internal
FINISH	Gunmetal grey case, off-white alphanumeric keys with black lettering, grey control keys with off-white lettering, blue stripe
SOFTWARE INCLUDED	None
SUPPLIED ACCESSORIES	Cassette cable RF cable Manual
DISTRIBUTOR	JVC (UK) Ltd, Eldon Wall Trading Estate, 6-8 Priestley Way, Staples Corner, London NW2 7AF

STAID AND RELIABLE – THE CONSERVATIVE MICRO



MITSUBISHI MLF-80

£299.00

Mitsubishi's £299 64K MLF-80 is a simply designed, workmanlike micro. But will the MSX buyer want more than this no frills package?

Three diamonds appear on ever so many electrical and consumer goods. You see them on cars, hi-fi, television sets, video recorders and, now, on computers. They are the symbol of the Japanese Mitsubishi Corporation.

If any Japanese company has a good grounding in computers, Mitsubishi is the one. Japan's largest manufacturer of professional mainframe computers, Mitsubishi is a specialist manufacturer of large scale integrated circuits (LSIs). With three home models on the market in Japan, Mitsubishi disk drive units are widely known across the computer world. Mitsubishi certainly has the credentials to be a leading light in the MSX field.

In the UK, Mitsubishi is launching two computers. One is the 48K MLF-48 model at a budget £250 price. The other model is the MLF-80, reviewed here. It costs around £299.

The computer you'll be able to buy over here is radically different from any of the Japanese machines. It has a different case, different key colours, different keys — Mitsubishi hasn't just taken a Japanese model and made it PAL compatible.

First impressions, tempered by exposure to most of the other MSX machines, are that Mitsubishi has come up with a workmanlike, unglamorous computer that is well made, meets laid-down specifications and won't disappoint any user. They haven't gone in for any special features. They haven't gone on a price cutting spree. They haven't tried to win Design Council awards. The impression given by the MLF-80 is that Mitsubishi wants to be all things to all men.

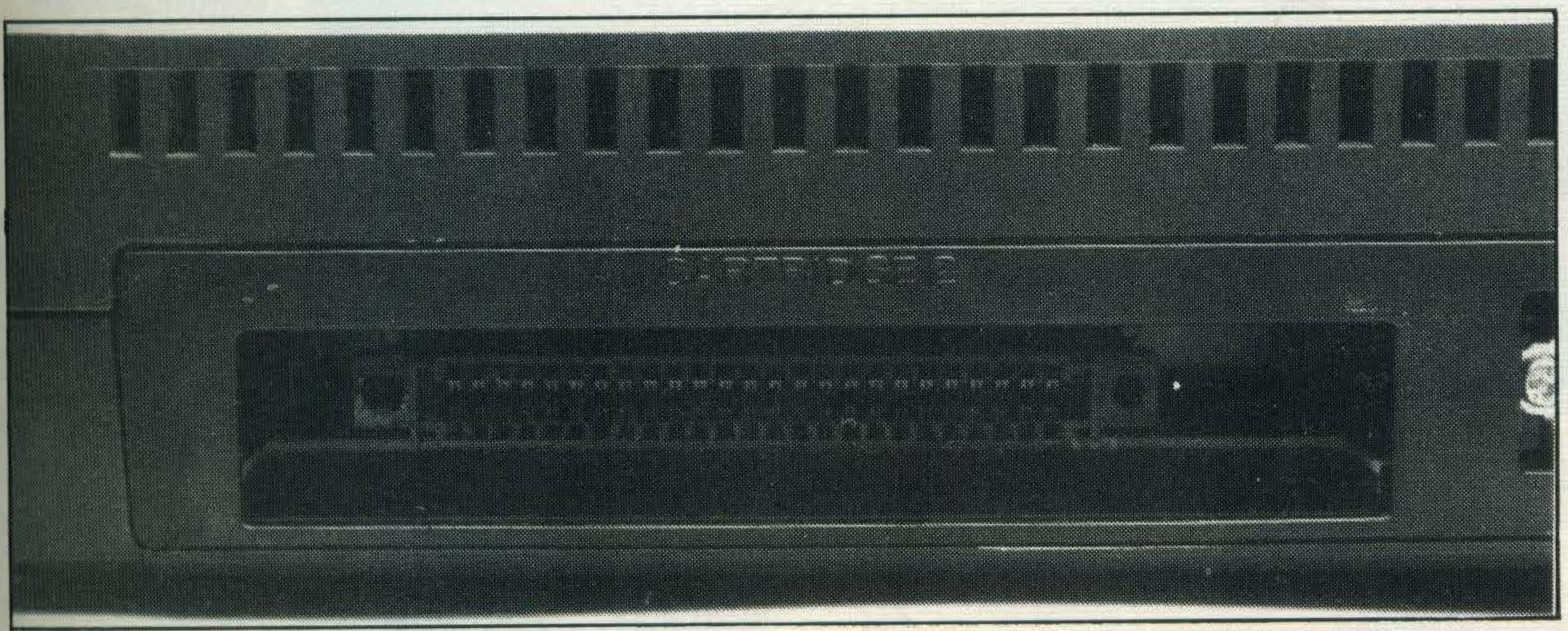
That approach means few will be disappointed, but, conversely, there is little to make the MLF-80 a crowd puller. Whether a middle-of-the-road, non-pretentious computer is enough to generate success in the fashion-conscious UK market remains to be seen.



The sample we had for review was one of only two PAL versions then in the country. That's why it lacks the distinctive Mitsubishi logo, and came without manuals, packaging or software. Getting scoop reviews has its drawbacks!

In the shops, the MLF-80 will come with cassette and TV leads, a 300 page manual, a demonstration program and a collection of four games. The power cable is permanently attached.

The style is heavy. Casing colours are black and dark grey, keys are dull white and pale grey with no bright colours to relieve the drabness — the Mitsubishi has a pedestrian look to it. There are those who don't go for gaudy colours and snappy designs. If that describes you, the Mitsubishi is a good looking machine.



The drabness does give an impression of solidity. This is emphasised by the complete absence of ventilation grills on the top, front and sides of the casing, the clean, angular lines and the orderly rows of keys. Oddly, Japanese Mitsubishi machines are light, bright and airy. Does that reflect on how the Japanese see the British computer enthusiast — drab and lifeless?

'The drabness does give an impression of solidity. Does that reflect on how the Japanese see the British enthusiast — drab and lifeless?'

There are no surprises in the locations of keys, ports and so on. Mitsubishi hasn't taken any risks through innovation.

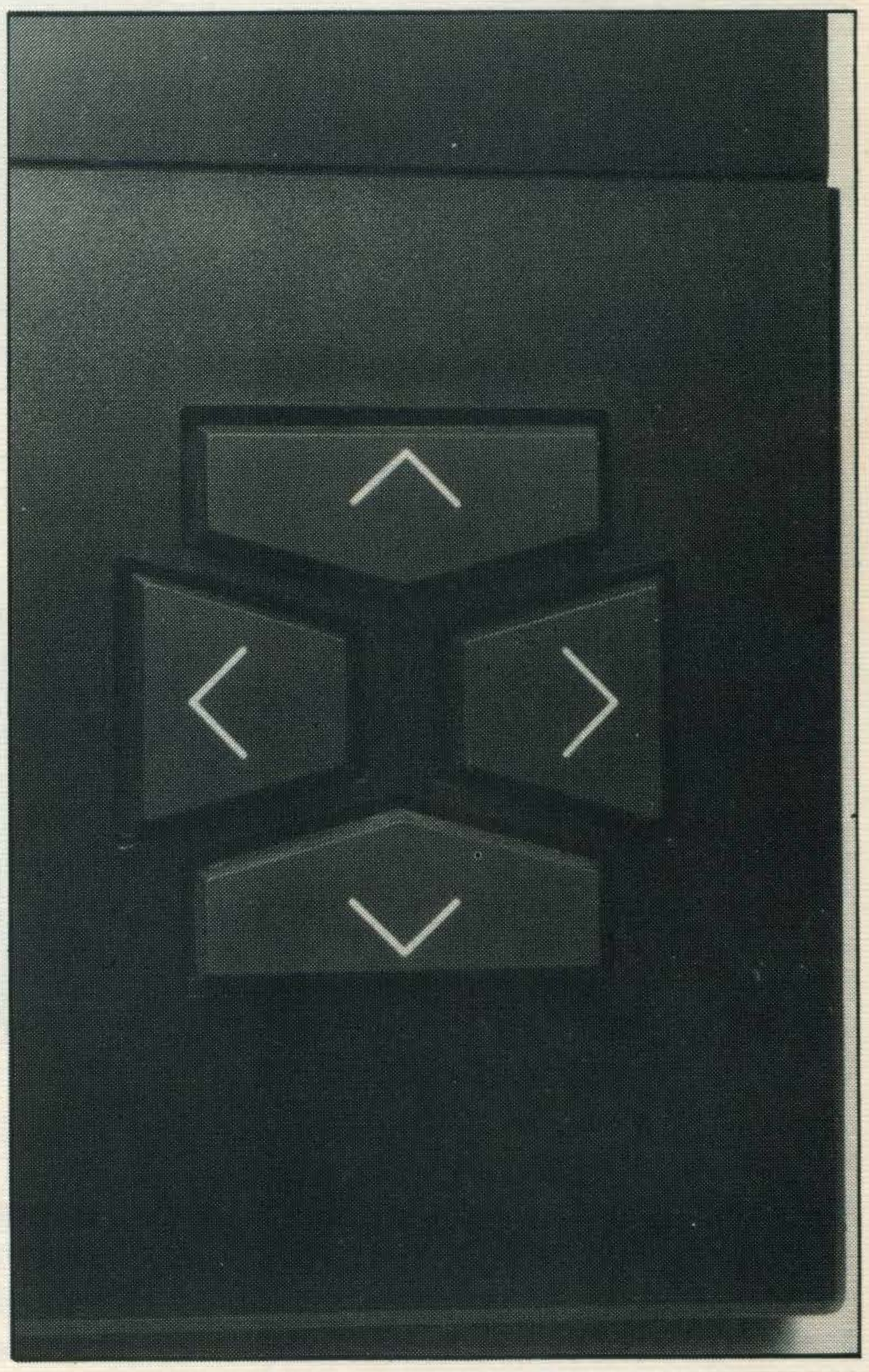
The standard of finish is high. The keys worked smoothly and have engravings liberally filled with paint though these may last less well than the embedded letter type. There is observable space around and between keys — that may lead to a dust problem, but this is countered by the lack of ventilation grids. Screws are well recessed and the computer feels comfortable and solid.

The keyboard has the requisite number of keys — 47 alphanumeric keys, four separate cursor control keys and other controls arrayed around the QWERTY keys. Alphanumeric keys are in matt white, other keys in a mid grey.

One key, next to the right hand SHIFT, is blank and serves no function. On Japanese machines it would be used. Other MSX machines have a similar key.

The only extra-large keys are the cursor control keys and the RETURN key. The latter key is easily found by the little finger when entering program lines.

STOP is found to the left of the function keys, users should have no problem pressing both STOP and CTRL keys at the same time with one hand.



Mitsubishi have opted for a clean, workmanlike style on the MLF-80, top. There is a second cartridge port on the back of the machine, above. Cursor keypad, right, is fine for games purposes

Inset in the CAPS LOCK key is a red light, which lights up when you are locked in upper case — a pretty standard feature on MSX machines.

The other keys are concave in cross section, so look like those on expensive electronic typewriters. The keyboard is rather flat though, and thus not quite as good to use as it might at first appear.

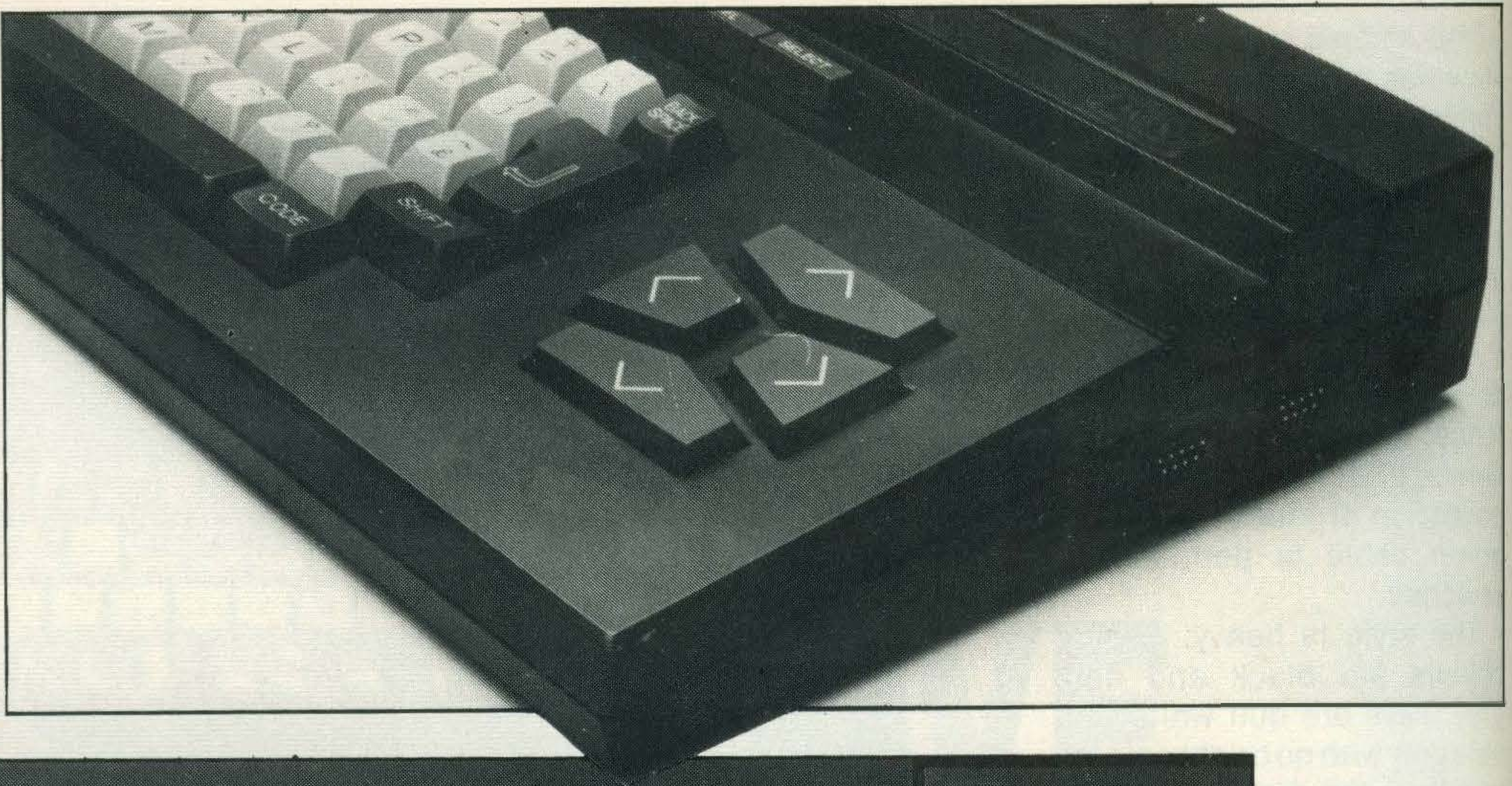
The upper control function keys are small and narrow. Being separate from the main keyboard, the function keys won't be pressed by accident.

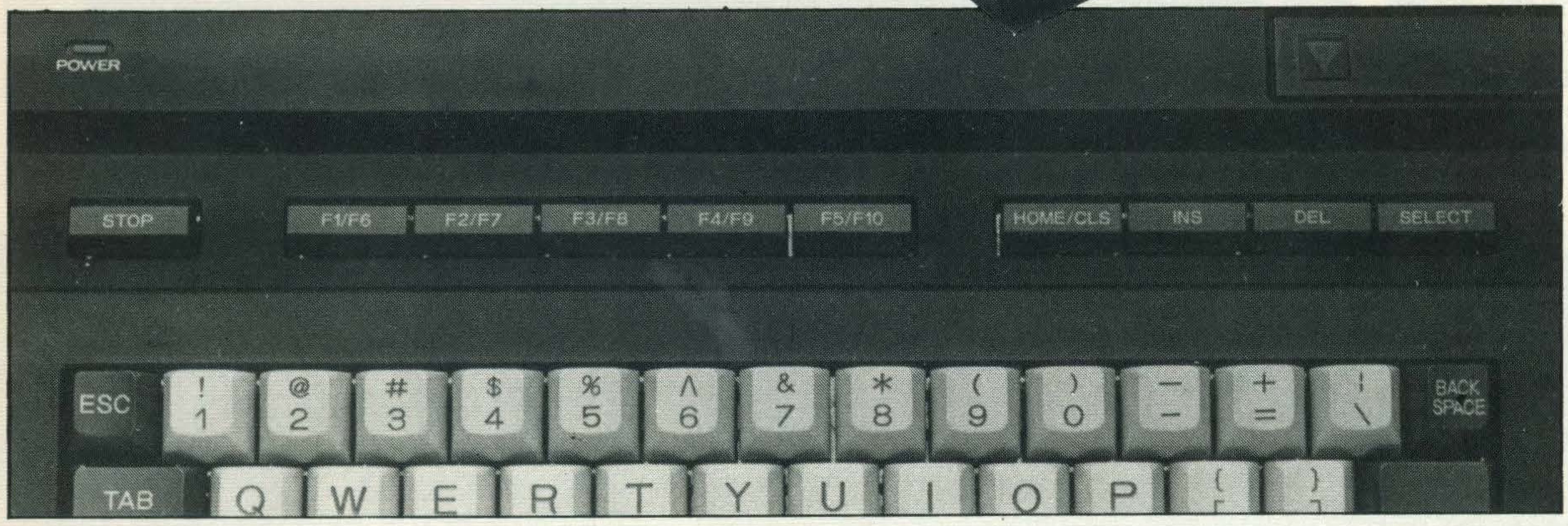
Cursor control keys will be much valued by the games player. They are not so close together as to be uncomfortable and large enough to be found in a hurry. The response is positive, and they make a joystick almost superfluous except perhaps for the fastest zap games.

Overall, the keyboard is a pretty fair effort. Given you don't need the help of bright colours to differentiate major keys, it is unpretentious and

easy to get used to. The keys lack a solid feel to them, so you can't always be too sure that a particular key press has registered, but given practice, you'll find the Mitsubishi keyboard no handicap to either word processing or rapid program entry.

Interfaces are the usual. The two-metre long power cable is permanently connected to the back of the computer. There's no chance that you'll lose an evening's work through the cable coming adrift. A green light on the top plate shows





Two joystick interfaces are on the right of the MLF-80, top. Function and control keys are laid out in an orderly fashion, above. Both monitor and TV outputs are provided on the back, bottom

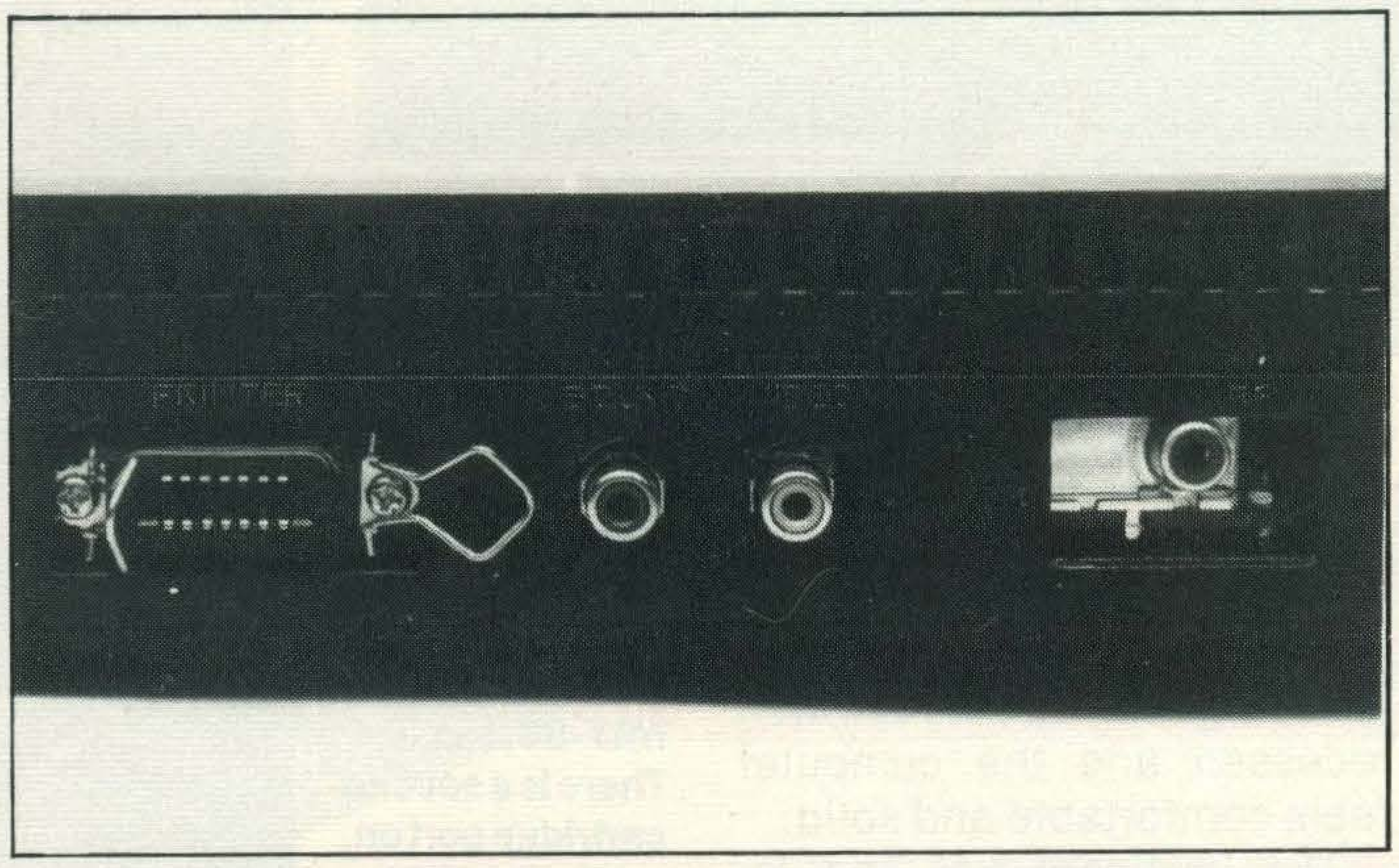
power is on.

The back of the casing also houses most of the other ports. All are clearly labelled.

At the cursor control key end is not the 50 pin expansion port. Mitsubishi have installed a second cartridge port, labelled CARTRIDGE 2, and it can indeed be used as a second port for games cartridges. Conversely, disk drives and so forth can be connected to the cartridge port on the top of the computer. If two games cartridges are connected, that in the top port takes precedence.

The second cartridge port is well recessed into the back of the Mitsubishi, with little shrouding. You can clearly see the innards of the computer, so don't go poking foreign objects in this port without due care and attention.

Mitsubishi haven't installed a 50 pin expansion bus, as found on many of the other MSX computers. The MSX specification only needs one cartridge port and Mitsubishi, along with other manufacturers are planning to make disk drives and so on that plug into a cartridge port. The two types of port have the same contacts, and are compatible in all but the fitting.



Next along is a parallel Centronics printer port with two snap back wire fasteners to hold a printer cable securely in place. Sound and video output sockets come next, and finally the PAL television socket. This again is rather exposed.

Legible

On the right hand side are two standard joystick ports and an eight pin DIN socket for a data recorder. On the left hand side is a rocker on/off switch. All these features are clearly and legibly marked.

The top cartridge port has a sprung flap, to prevent the entry of dust. Cartridges slip in and out easily but remember to turn off the computer when changing cartridges.

The Mitsubishi will therefore interface quite happily with any of the vast number of MSX accessories due to hit these shores in the next few months. The designers have not tried to stretch the meaning of compatibility and have been quite content to fulfil the MSX standard, as laid down.

'Mitsubishi plan to market more than just two MSX computers. Before the end of the year they should be making joysticks and data recorders available'

Performance is well up to scratch. Having a transformer in the main casing might have caused heat dissipation problems, particularly given the limited ventilation grills on the top and sides of the Mitsubishi. There are grills on the back and base of the machine, and even after many hours running, there wasn't a real heating problem. The top left of the casing was definitely warm to the touch but this is something almost all computers suffer from.

Sound and picture quality is first class, though, of course, both are dependent on whether the output is through a monitor, television set, amplifier or whatever. Through the same monitors, with the same programs, we found the Mitsubishi to give results indistinguishable from thoseof other £300 MSX computers. Set the tuning up correctly at the start and you will be more than happy with the results.

Mitsubishi Electric (UK) Ltd told us that they were having

the 300 page Japanese manual translated into English. They are very concerned that the manual should be informative, readable and entertaining. It will have dozens and dozens of short example programs too, plus a command by command summary of MSX BASIC.

The software written to accompany the computer is a mixture of home grown and Japanese material. The demonstration program will be graphics orientated, to show off the best features of MSX in a colourful manner. The games (three, possibly four in number) have names such as Snake Snack and Catchman. There will also be a clock program that keeps accurate time once set.

Mitsubishi plan to market more than just the two MSX computers. Before the end of the year they should be making joysticks and data recorders available. They already make disk drives, imported under their own name or branded for other companies. Their own MSX compatible disk drive will be along next year though price and size are yet to be announced.

Looking at the brochures and bumph for the Japanese Mitsubishi computers, you get an idea of the sort of peripherals thay are thinking of. Of course Mitsubishi owners will be encouraged to connect their computer up to a Mitsubishi television set or colour monitor. Other possibilities easy to envisage are Mitsubishi hi-fi, amplifiers, cassette systems and so forth. Printers, 8-inch format disk drives, RS-232C interface cartridges, modems and RAM expansions are foreseen. There are even pictures of robot arms and a 'TV printer'. Mitsubishi seem keen to get involved in MSX up to the hilt.

Of course all their accessories should, in theory, fit any other MSX computer, and a good range of peripherals doesn't guarantee a best selling computer. The MLF-80 must stand on its own four feet!

Compared to the other machines competing in the MSX marketplace, it has nothing special to offer. It is not a budget machine. It has no attention grabbing features. It is a standard MSX computer.

The main strengths then lie in the MSX system itself — guaranteed compatibility and an excellent BASIC.

To someone who is in the market for a first time computer and thinking of spending around £300, the Mitsubishi will seem a pretty fair bet. It will be sold on the merits of the MSX system, rather than any particular features. With a good demonstration program up and running, a good patter from a sales person and the promises of all sorts of goodies that can be used with your computer, the conservative, conventional styling of the Mitsubishi will appeal. It would certainly not look out of place in an office.

By comparison, potential customers may realise that competing machines offer better value for money, a more attractive, brighter casing, a more professional keyboard, this, that and the other.



Early production review sample seen here without silk screen brand name

LIKES

Robust appearance
Cursor control keys

MITSUBISHI MLF-80 £299

SPECIFICATION

CPU	Z-80A equivalent (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K MSX BASIC
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	47 Alphanumeric 23 control keys Keypad cursor control
NUMERIC KEYPAD	No
VIDEO DISPLAY	
TEXT	40 characters × 24 lines
GRAPHICS	Maximum resolution 256×192 pixel
COLOURS	16
SPRITES	32
OUTPUT	TV Monitor
SOUND	
GENERATOR	3 channels with 8 octave range
OUTPUTS	Mono audio output (RCA phono) 150mV/10kOhm Standard
INTERFACES	
JOYSTICKS	2 Atari standard
EXPANSION BUS	No
CARTRIDGE PORT	2
PRINTER	1 × Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	No
DIMENSIONS	370×270×70mm (W×D×H)
WEIGHT	2.7kg
POWER SUPPLY	Internal, captive mains lead
FINISH	Black plastic case, grey keys with black lettering
SOFTWARE INCLUDED	3, possibly 4, games 1 graphics demonstration
SUPPLIED ACCESSORIES	1 video cable 1 audio cable Instruction manual
DISTRIBUTOR	Mitsubishi Electric (UK) Ltd, Otterspool Way, Watford, Herts WD2 8LD Tel: 0923 770000

DISLIKES

No true expansion bus
Little pricey
No distinguishing features

Verdict

If Mitsubishi come up with a really excellent manual and some super software, they may have a good selling aid. Their 48K machine, with a £250 price tag should be an attractive proposition too, even though it has less memory.

The £299 MLF-80 MSX computer makes the grade as far as MSX computers go. The omission of a true expansion port is no real drawback. It may not set the enthusiast world alight, but those after a reliable, solid MSX computer won't go far wrong with the Mitsubishi.

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CLASSY KEYBOARD

The £299 Sanyo MPC-100 has the quality feel of the company's business micros

Computers are nothing new to Sanyo. The company has been in the 8 and 16 bit business micro field for some time, with machines ranging in price from £700 to £2,000. And Sanyo is one of the few companies to have a dedicated computer factory — indeed, it owns a separate micro company, which makes many of the chips in the Sanyo MSX machine.

Along with video and TV, micros are the company's main form of income, although it also makes other electronic consumer products — portables (radios and cassette recorders), personal stereos, in-car entertainment and microwave ovens.

At the business end, the company makes calculators, answering machines and dictating machines.

To distribute and market the products in the UK, Sanyo teamed up with another Japanese company — Marubeni. And the British operation is completed by another Sanyo offshoot. This has a factory in Lowestoft making video equipment.

In Japan, Sanyo is also well-known for innovation in the field of solar energy, and for white goods — fridges and the like.

So much for the company, what about the machine? Well, in Japan, the 64K micro is called the Wavy 10. But like other manufacturers, Sanyo has decided against silly names for the British market, and has given it the more sober title of MPC-100

It's a fairly impressive looking machine. It doesn't have the brightly coloured jazziness of some home micros — instead Sanyo opted for the professional, business-like style of the more expensive micro computers.

You can have the MPC-100 in any colour you like, so long as it's black. Oh yes, and a bit of silver too, the rear top section being in the latter colour.

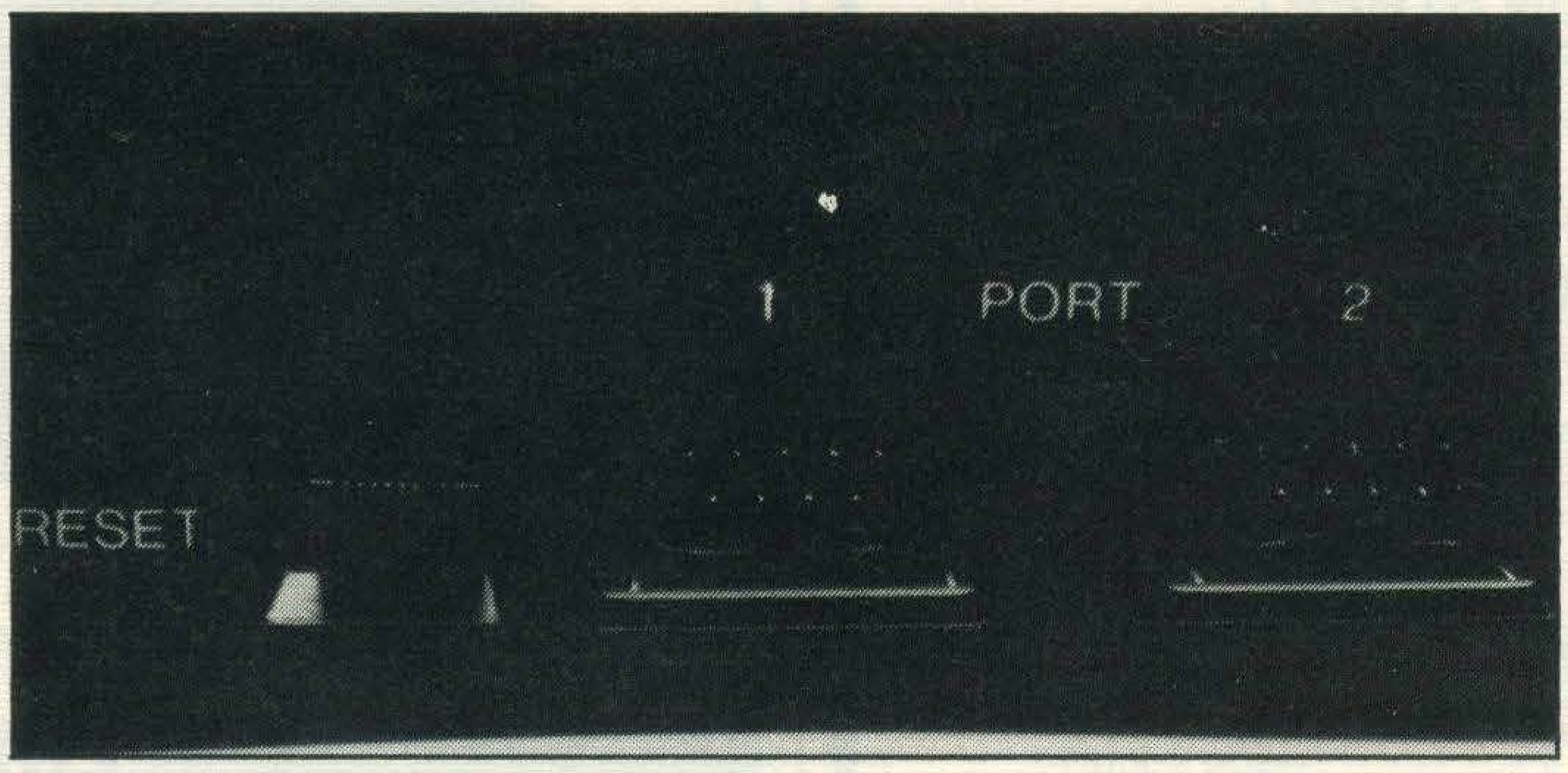
The keyboard is also black, with white lettering. This is very readable, even when your eyelids are drooping after a hard night's hacking. There are no specially coloured keys, but it's easy enough to find the ones you want.

The keyboard is sloped, giving a very pleasant typing angle. And the low level of the front of the machine will be appreciated by those who like to rest their wrists when working.

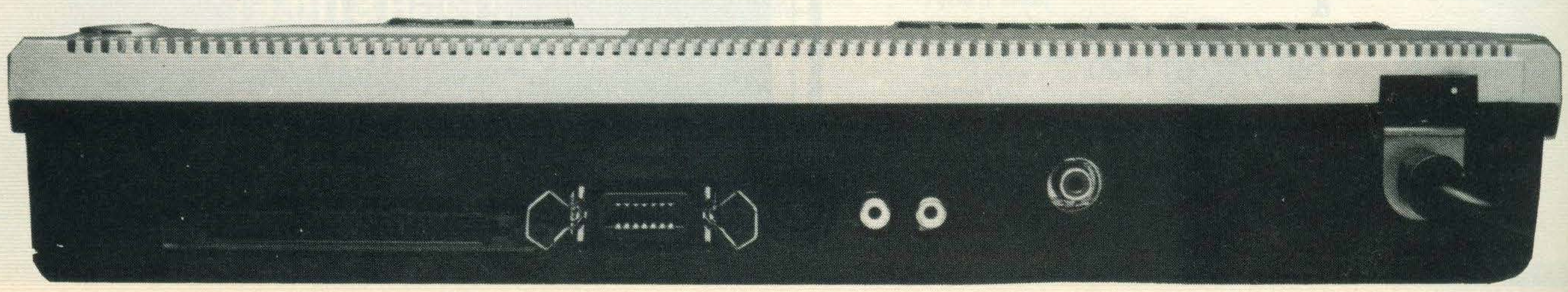
The keys are sensibly laid out, with generously large **RETURN** and function keys. The cursor key cluster is also well-designed, and is one of the best we've seen for games playing. And that's helped further by the excellent responsiveness of the keys — we can heartily recommend this



High keyboard quality is carried over to the cursor pad



Reset button is conveniently located on the right side of the machine



Back panel of the MPC-100 holds no surprises. On/off switch set over the captive mains lead

WITH A LIGHT TOUCH



SANYO MPC-100
£299.95

machine for applications which involve a large amount of typing, such as word processing or entering data.

The keyboard is completed by two small lights. There is quite a large LED above the editing keys which indicates POWER ON. And the **CAPS LOCK** key has a small red LED on the top of the key itself — a good design feature even if the light could have been a little brighter.

The Sanyo has a fairly standard selection of sockets. The cartridge port is on the top, to the righthand side. On the right side panel you will find the two joystick sockets and a reset button. Most of the machines we've seen have to be 'hard' reset with a quick 'flip' of the power ON/OFF switch.

That's fine for occasional use, but if you tend to do a lot of resetting a proper switch is preferable — there is less chance of damage to the electronics. The button on the MPC-100 is well hidden, so you're unlikely to press it accidentally.

'There are no specially coloured keys, but it's easy enough to find the ones you want'

Most of the sockets are on the rear. Looking at the back panel, going left to right, are a 50-pin expansion port, Centronics printer port, DIN cassette socket, two phono sockets for audio and video composite monitor output, TV phono socket and lastly, the ON/OFF switch. Nothing unusual or remarkable there.

One feature which has been left off the MPC-100 but was included on the Japanese Wavy 10, is a light pen socket. This was originally on the right side panel, next to the joystick sockets. This was removed when the computer was upgraded from 32K to 64K.

There is still a place to park your lightpen, however. Next to the cartridge port is a round plastic panel with 64K written on it. Pull this off and you'll discover a socket designed to hold the light pen while you're not using it.

Although there is now no direct plug-in provision for a light pen, Sanyo is making a cartridge-based model. The pen plugs into the cartridge, which in turn plugs into both the cartridge port and the RF TV output. You then plug the television's aerial cable into the cartridge.

'The computer is well finished, and that applies to the insides as well as the case'

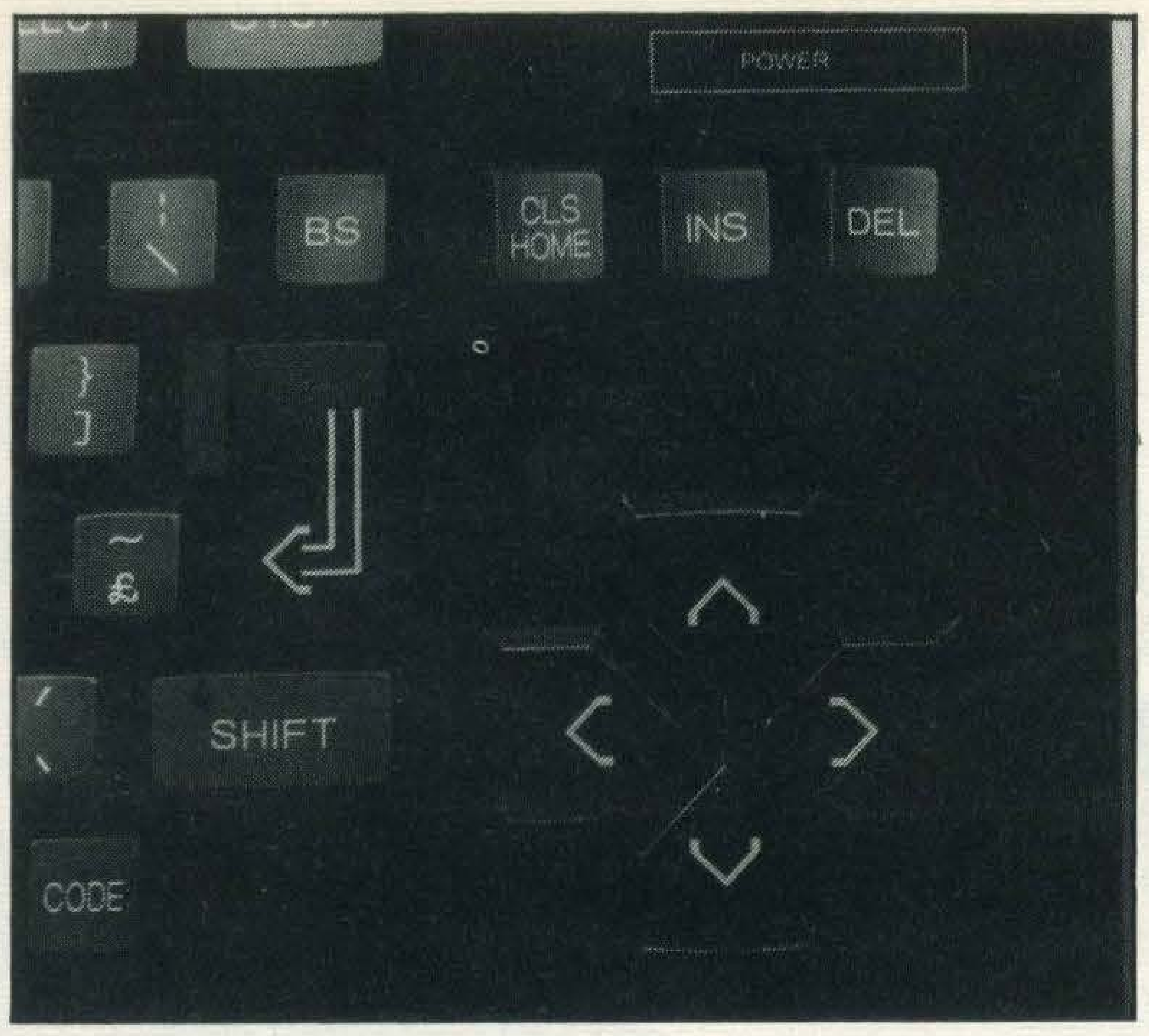
Some packaged software comes with the cartridge, allowing you to draw on screen with the light pen. The program includes routines for drawing squares, fine and thick lines, painting with a spray gun effect, filling shapes with colours, and a host of other features. The whole lot costs

around £90, which is pretty steep for a lightpen, although the quality is very high.

Indeed, the general quality of Sanyo's machine is high. The computer is well finished, and that applies to the insides as well as the case.

Opening up the machine reveals a very neat printed circuit board (PCB) arrangement. There is a large board carrying all the main chips. Next to this is a much smaller board handling the power supply — this has a remarkably small transformer compared with some of the other machines.

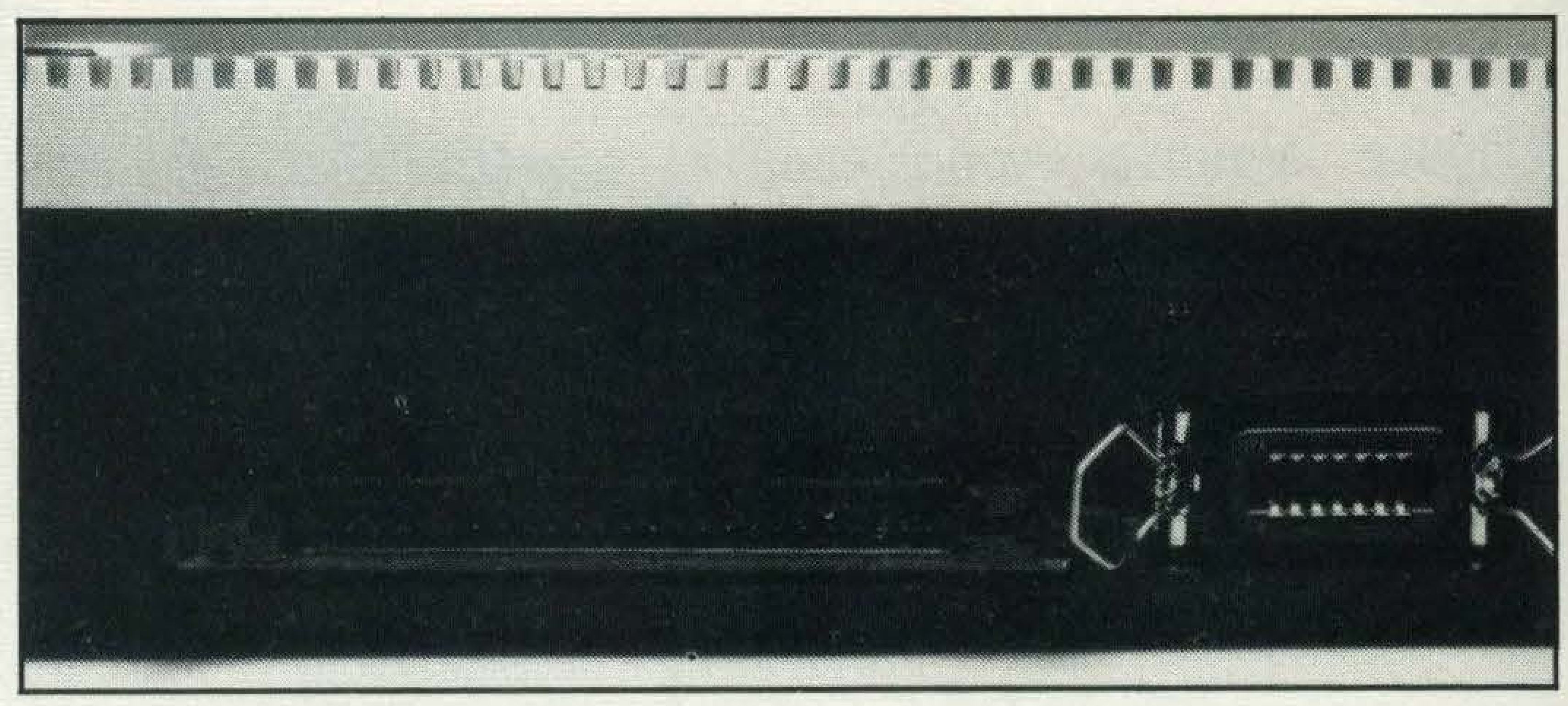
'The software doesn't live up to the high standard set by the rest of the package'



Interlocking design and full travel keys make the Sanyo cursor ideal for games



The 64K 'button' snaps off to reveal a holder for the optional light pen



Lockable expansion bus socket. Note cutouts on shrouding may prohibit use of some plugs. Centronics interface to right

The only part which isn't securely fastened is the PAL encoder. This is on a third board clipped to the back panel of the machine — not a screw in sight. It wobbles a bit when you plug the TV lead in, but shouldn't cause any problems.

There are a few details on the main PCB which suggest that the sample we had wasn't the fully finished production model. Several chips were plugged, rather than soldered, in. These included the Texas video ROM, and what look like the language ROMs.

There was one PCB track scratched out, and some strange bits of soldering, with resistors being joined together to form patches. Mind you, it all worked perfectly well.

There is little heat sinking of the circuit boards, and there are only a few, small ventilation grilles in the case. But the machine didn't seem to get unreasonably hot. Indeed, this micro ran cooler than others with large grilles.

The general quality of construction is very good. The whole of the underneath of the keyboard is supported by a metal plate, securely fastened to the upper half of the case. And the cartridge socket is completely encased, preventing dust from getting inside the machine. The case itself seems fairly strong, and capable of taking the sort of knocks a classfull of children might give it.

This was the first MSX micro we have had in the office, and it has performed without a hitch since we got it, in spite of the fact that it is obviously a review sample which hasn't been treated too gently.

Colour and sound were well up to scratch; the Sanyo was really the machine by which the others were judged. Theoretically, MSX computers shouldn't differ in the quality of their sound and picture. But differences do occur, which perhaps can be put down to variations in quality of manufacture, quality control and differences in the choice and design of PAL modulators.

It's a fairly professional, if hardly exciting, micro. But what about the rest of the stuff you find in the box? As well as the machine there are the usual leads — TV and cassette — a manual, and two software demonstration tapes.

The manual was nowhere near complete when we saw it. All we had were photocopies of page proofs bound together. All the diagrams were missing (although the labelling and captions were there), and there were obviously a lot of corrections to be made.

Manual

Nevertheless, this rough version did give some idea of what the final manual will include. As well as sections on the essentials of BASIC programming, each keyword gets its own section with full explanation of syntax and examples of usage. In addition, there are memory maps and useful information on addresses for those already into programming in MSX machine code. The manual doesn't really give a BASIC tutorial, but that's better dealt with by other publications — like *MSX Computing* magazine!

The software, unfortunately, doesn't live up to the high standard set by the rest of the package. It's written by Knight's of Aberdeen, who have supplied software for other machine manufacturers,



High spec MPC-100 keyboard will appeal to users with words to process or data to enter

LIKES

Quality of keyboard

Solid construction

Reset button

including Toshiba. Indeed, some of it is the same software, with only the name being changed.

One tape contains two games— Exploding Atoms and Vicious Viper — which, as far as in-box software is concerned seems to be unique to Sanyo. However, our information suggests that Knight's may be selling the games individually.

Both games make minimal use of the sound and graphics capabilities of the machine. When you consider the wonderful possibilities offered by MSX BASIC you start wondering how the writer of these programs managed to produce something so dull.

Vicious Viper is a barely adequate version of the old centipede game. Exploding Atoms is a strategy game, and marginally more interesting because of that. But the way the screen background colour keeps flashing might end up giving you a headache.

The same low standard is maintained on the other tape, which includes an introduction to the Sanyo system and

DISLIKES

Poor software supplied

Price slightly high

machine. For most of it you could wipe out the name Sanyo, write in Toshiba, and experience a heavy sense of *deja vu*. There is also a Typing Tutor, aimed at making you familiar with the keyboard.

The lack of imagination and low standard of implementation may have something to do with the fact that the software was produced fairly quickly. But if that's the case, why didn't Sanyo opt to translate some of the excellent Japanese software, which has been around for some time now. This goes for other manufacturers too.

The MPC-100 will initially be sold through High Street stores, such as the big name electrical retailers, both independents and multiples. There are no plans at present to go into Sanyo's traditional micro retailers. That's because those shops are generally more committed to the business end of the market.

As well as the lightpen outfit already mentioned, Sanyo are launching a joystick at the same time as the machine. This is identical in every respect except colour to the Toshiba, Canon and JVC models. It costs £12.95, which is fairly average. Disc drives are planned for next year.



Light pen unit interfaces to the CPU through the cartridge port. Familiar MSX joystick seen here in Sanyo guise

Verdict

The poor software might make a purchaser feel that he or she has been sold a dud. That's a shame because the Sanyo is one of the best of the MSX machines in terms of quality.

The retail price of £299.95 puts the Sanyo among the top-priced of the MSX micros, without it having anything special to offer (such as the Sony's built-in software). But many people may feel the extra expense justified by the quality of the product.

SANYO MPC-100 £299

SPECIFICATION

CPU	Z-80A equivalent (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K MSX BASIC 16K Firmware
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	47 alphanumeric 25 control keys Keypad cursor control
NUMERIC KEYPAD	No
VIDEO DISPLAY	
TEXT	40 characters × 24 lines
GRAPHICS	Maximum resolution 256×192 pixels
COLOURS	16
SPRITES	32
OUTPUT	TV Monitor RGB
SOUND	
GENERATOR	3 channels with 8 octave range
OUTPUTS	Mono audio output (6-pin DIN) 150mV/10kOhm standard

INTERFACES	
JOYSTICKS	2 Atari Standard
EXPANSION BUS	None
CARTRIDGE PORT	2
PRINTER	1× Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	Yes
DIMENSIONS	385×240×63(mm) (W×D×H)
WEIGHT	2.2kg
POWER SUPPLY	Internal, captive mains lead
FINISH	Black plastic case with silver finish, black keys with white lettering
SOFTWARE INCLUDED	1 cassette, 4 programs
SUPPLIED ACCESSORIES	1 video cable 1 cassette interface cable Instruction manual
DISTRIBUTOR	Sanyo Marubeni (UK) Ltd, Sanyo House, 8 Greycaine Road, Watford, Herts WD2 4UQ Tel: (0923) 46363

FREE MICRO WITH EVERY £300 DIARY

SONY HIT BIT HB-75

£299.00



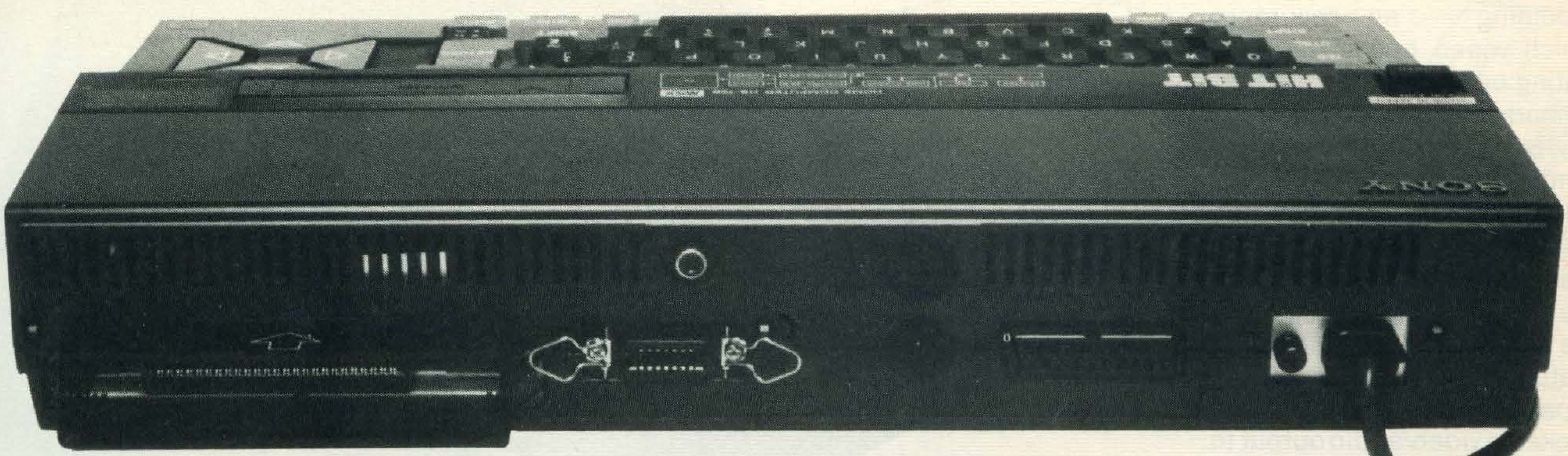
The Sony Hit Bit is unique among the MSX micros in having highly useful built-in software

Sony is unique among the Japanese electronics corporations. It is rarely appreciated by Western buyers that Sony is small fry alongside the Japanese corporate giants Mitsubishi, Hitachi or Matsushita. Car and ship building, power station and reactor design, turbines, lifts, domestic electrical goods, electronic component manufacture; unlike its corporate brothers Sony is involved in none of this, having its base firmly in consumer electronics.

Sony's attitude to what it does is also uniquely Western for a Japanese company. This attitude is a company-wide reflection of the ideas of the company father and figurehead Akio Morita, a jet-setting go-getter, a modern Japanese businessman without peer. His attitude to 'electronic living' pervades the design and concept of much Sony product. He too was the first Japanese magnate to buy production facilities in export territories. Who could forget the topsy-turvey Queen's Award to Industry that Sony received for its television plant in Wales?

Sony learned a major lesson from its Betamax video format fight. Betamax never captured the video rental market in the UK and lost out to VHS time and again. Sony was no doubt stung by the lack of a 'run-away' success with its video format.

The next few years saw Sony gingerly testing the video disc waters and then an unprecedented tie up over audio Compact Disc technology with



The rear panel includes a cartridge port (left) and RGB output (right)

Duch-based international Philips. Sony seemed to be learning fast about the necessary evils of standardisation. Come the domestic computer revolution in Japan, the MSX standard, and Sony is to be found in there competing hard with a product refreshed by the company's traditional flair for style and innovation.

Sony is not content with simple marketing of consumer electronics; reflecting Morita's attitude, Sony produce must be seen to be bound in with a quality of and approach to living. No other company has scored so well with product names like Walkman, Trinitron or Profeel. Of course the Sony MSX micro comes with its inimitable Sony name tag — 'Hit Bit'. But I don't think even John Cleese stands a chance of marketing that name into the staid British consumer's stoney heart.

Processor

Sony's £299 HB-75 is based around the minimum MSX specification with Z80 processor driven 64K RAM, MSX BASIC, 16K dedicated video RAM and a three channel, eight octave sound chip. Whereas that completes most MSX micro packages, for Sony's it's just the start. Sony has provided a unique 16K ROM chip with an organiser program in firmware that provides the Hit Bit with a unique start-up mode.

Innovation doesn't stop there as Sony has on offer a CMOS RAM cartridge of 4K capacity which can be used for data storage and manipulation when used in the 50 pin I/O cartridge slot. More about this feature later.

Straight from its packing the HB-75 strikes you as being one of the neatest of the first generation MSX micros; it's not the smallest but presents a low profile and a neatly ordered key layout. The easy-to-read black plastics QWERTY-type keyboard is supported by grey control keys.

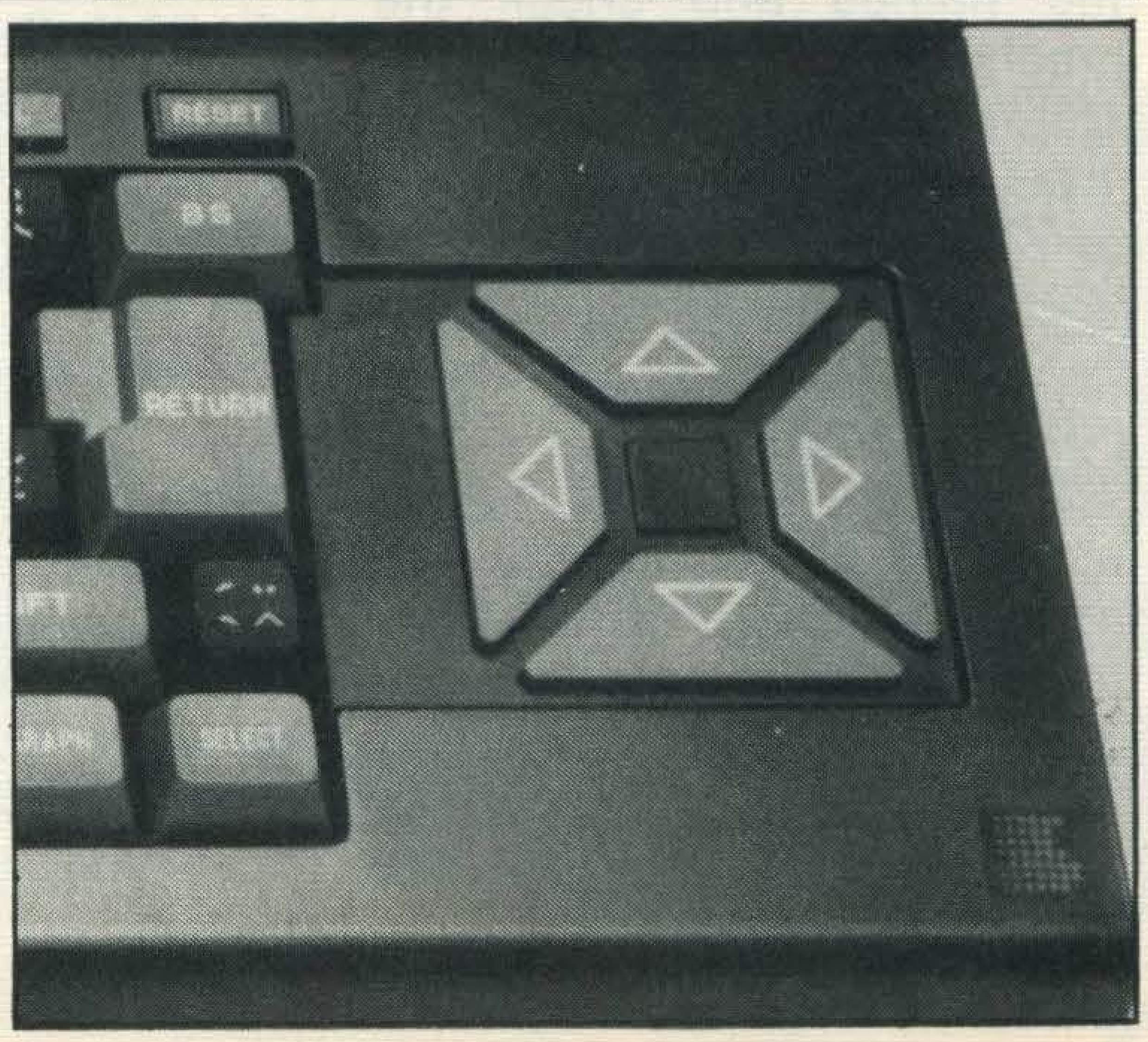
The five function keys take up the top left position on the keyboard proper and are to my way of thinking too small for the use to which they should be put. The **CLS HOME,** cut and paste (**INS**ert and **DEL**ete) function keys are found to the top right of the keyboard along with the **STOP** key. The **RESET** feature lies alongside with a shrouded moulding preventing accidental crashing.

Though the QWERTY-type keyboard is a well designed full-travel type rivalling, in my view, many electric typewriters and bettering every other MSX keyboard I've tried bar the exceptional Sanyo, the Function keys just don't come into this category of excellence at all. The keyboard has a good positive feel especially the space bar which on too many other MSX machines is poorly designed or placed. The **RETURN/ENTER** key too is well proportioned and placed like the over-sized carriage return key on a conventional electric typewriter keyboard. The kana character shift key which on the Japanese NTSC model changes the character set is used on the UK PAL version of the HB-75 for four foreign language accents; the £ sign and important double inverted comma keys are found in the bottom left of the keyboard not on the shift 'upper case' of keys 2 and 5 as would be found on a conventional keyboard.

'No other company has scored so well with product names like Walkman, Trinitron or Profeel'



A printed message by the cartridge port warns of leaving the power on when changing carts



The keyboard looks superb, but some keys are too small

Typists will find it takes time to get used to many MSX keyboards but Sony's less time than most. Particularly welcome were the little plastic pips on letters F and J to mark the 'starting position' for touch typing. The function keys are of the micro switch type and do not match the quality of the rest of the keyboard.

The main power switch is shrouded like the **RESET** function key and is to the left of the main fascia, a big improvement over the 'round the back or down the side' placement of the power ON/OFF switches on many other machines.

The cursor pad is to the right of the keyboard. A central square moulding allows 'blind' alignment of the fingers on the keys. Sadly the cursor pads are of the microswitch type and the Hit Bit cursor pad is a very poor games playing option alongside the excellent Sanyo full travel key arrangement, or the keys on the Toshiba HX-10. With hard games playing, though not of the 'batter your micro into submission Olympic Games' type, the cursor keys offered a less than positive response and would on occa-

sion catch on the keyboard moulding — an occurence which wiped out a few fruit-eating bees, and had me both embarassingly shot out of the sky and blown up by my own bombs.

Input/output options on the HB-75 are comprehensive. The Atari standard joystick ports are found on the right side of the machine. The back panel features a shrouded 50-pin expansion bus, an RF phono socket, a video/audio output to 6-pin DIN standard (stereo just around the corner?), an RGB output (extra to the basic MSX spec) and the conventional 8-pin DIN remote control tape record/play socket. A Centronics interface is, of course, also featured. The RGB output on a Sony micro is no surprise considering Sony's own interests in modular TV and the provision of RGB sockets on its Profeel monitors.

Extra hook-up options aside, the real addition to the basic MSX specification is the firmware. As soon as the HB-75 is fired-up it does not go directly into BASIC after the familiar blue and white 'MSX system Version 1.0' screen has appeared. A menu of options is

'The HB-75 strikes you as being one of the neatest of the first generation MSX micros'

presented under the Hit Bit logo. Address, Schedule or Memo files are offered, the fourth option being data Transfer. A fifth option, outside the main menu, is for BASIC; selecting this produces the familiar blue and white BASIC screen seen on all other MSX machines. The cursor and **RETURN** keys are used to select from the menu.

Say, for instance, the Address files are chosen. Again for use with cursor and **RETURN** keys a list of options is displayed across the top of the screen: Files, Search, New, Menu. The contents of the Address file can be displayed, the content searched or a new file created. The Schedule, Address and Memo programs are identical in scope and operation. The Files option displays all the files with a cursor/**RETURN** select option. Schedule is automatically headed by Date. Address files are ordered by Name and by Telephone Number which double the use of this file. Memo files are headed by Subject.



Creating a new file asks for a file name of up to 25 characters. Though the dates in the Schedule files and subjects in the Memo files fell within this restriction it proved difficult to enter readily 'searchable' names and telephone numbers for multiple relatives with a long family name all living in a British Telecom area with a four digit area code and a six digit number. A two line code name would have been more appropriate for Addresses.

The entry of the name and telephone number, date or subject is accepted with the **RETURN** key, a 'card' then opens up with 9 lines of 25 characters. There is no way the file size can be extended but for all my uses of this memorandum and address book system file size proved to be no real restriction.

The Search facility opens up a display of stepped 'cards' which read, in order, Title, Keyword, Sorting (abc, ABC, 123). Search does not describe the function fully. Title will look at file names, though I found I needed first to list the file names and check the precise nature of the file name I required. Had I, for instance, created the file under the name of CAMPBELL,R; CAMPBELL, Robert; or CAMPBELL, Bob?

Keyword proved the most powerful searching tool. I initially entered my address book as simple 'phone numbers and addresses but soon realised that additional information about late posting dates for relatives abroad, of birthdays, anniversaries and the like could just as easily be held on the file cards.



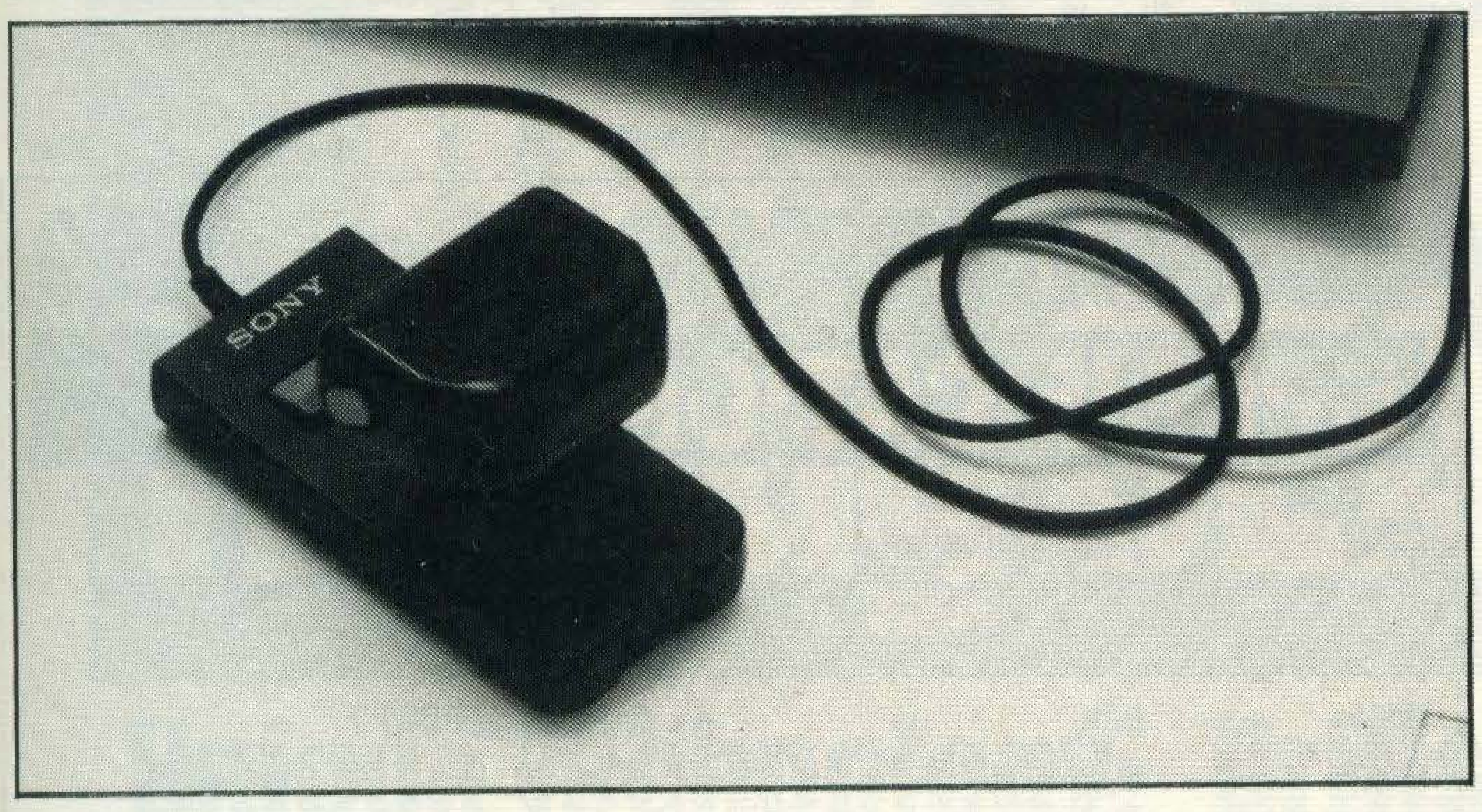
The disc drive interfaces via a special cable and cartridge. This plugs into the rear cartridge port

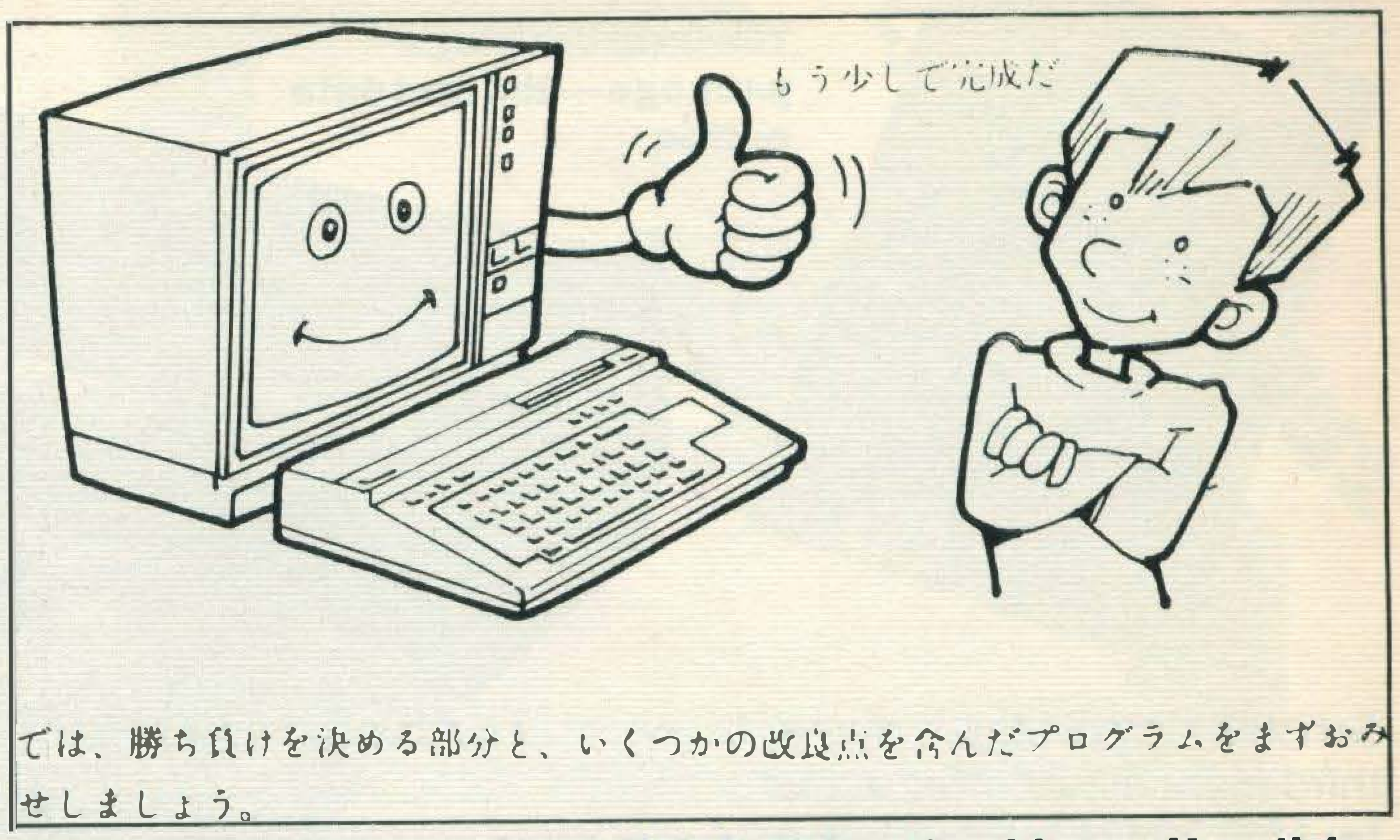
The use of the Keyword function will call up all addresses of relatives living abroad who need Christmas cards posting early. The Keyword function will pull out all the birthdays, all relatives or friends living in Manchester (just use 061 as the search keyword for the Manchester telephone area).

Sorting is very useful as new files are added, not too surprisingly, to the top of the file pile. Sorting can be by number, small letters or by capital letters. If you are using a tape as a backup there seems to be no limit to the number of files you can load and store, though the Data Cartridge will impose limitations. The 4K byte storage suggests a limit of less than 20 full file cards with 225 characters on each; the less you put on the cards the more you'll be able to store.

To understand fully the op-







The peripherals are pretty stylish, both the disc drive and joystick (left) being available at launch. The Japanese manual's illustrations are less stylish. Unfortunately, an English manual wasn't available to us

eration of the Hit Bit firmware follow the transfer of information from the address file to tape. With the address file updated and ready for storage you 'escape' back to the menu and select Transfer. Symbols offer transfer from tape, to tape and Menu options.

Using the cursor and **RETURN** keys Transfer to tape is selected. Chatty, on-screen instructions ask you to select the file you want, to place the cassette deck in the record mode and then to hit **RETURN**. Once the file has been recorded the Hit Bit will ask for an immediate replay to verify the data, a useful 'belt and braces' option that ensures safe storage without loss due to tape dropout problems.

Transfer of data from tape is as simple, following the graphics and straightforward instructional frames. The HB-75 will not load the schedule data into the memo or address files and will skip until it has found the right file name when it will display 'Found it!' on screen with obvious relish.

Pushing the Data Cartridge into the Hit Bit's cartridge slot opens up more convenient storage possibilities. The start-up menu will now show Data Cartridge and BASIC options as well as the copy possibilities to take information from tape to cartridge and back. The Data cartridge can be used to store a whole program if the Data Cart/BASIC option is selected and the SAVE "CAT:" command used.

The cartridge can be then carried over to another MSX micro and the program downloaded using LOAD "CAT:". It saves messing about with tapes or recorders and offers very quick loading of moderately long programs. Only one program can be stored at a time though which means that Sony may well have a rush for Data cartridges on its hands despite the £30 price tag for only 4K storage.

For the technically minded the 4K Data cartridge is a lithium battery powered dynamic RAM with a claimed five-year life. A red warning note on the Hit Bit reminds users that for the sake of the firmware, carts should only be loaded and unloaded when the mains power is switched off. You have been warned.

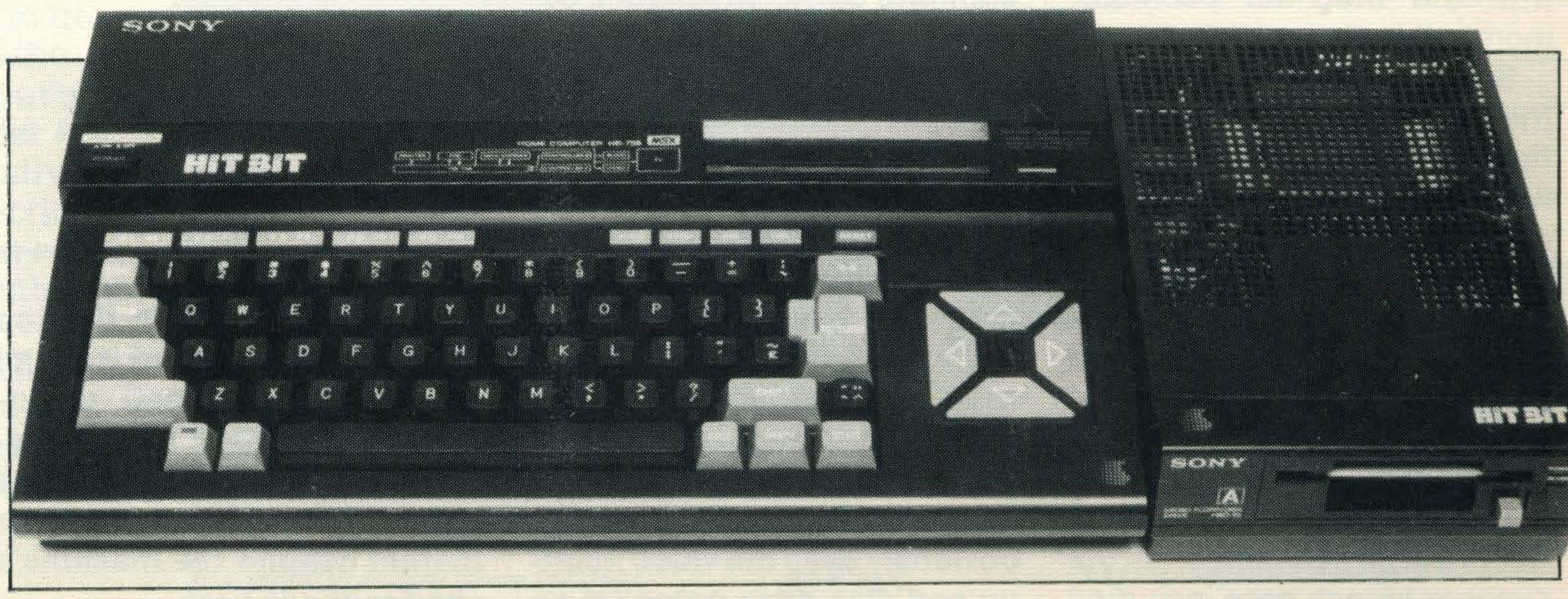
Early samples we received of the HB-75 in NTSC or PAL mock-up versions were either capable of only fair picture quality or had been 'vandalised' by previous reviewers. Finally, Sony were able to deliver a fully working 240v PAL model with excellent picture quality. Picture and sound quality has proved surprisingly variable even with production MSX machines; Sony's experience in the TV and audio field has obviously paid off here.

The case on the finished model has good non-slip feet and though only moderately well provided with ventilation slots the HB-75 does not run unduly hot despite the on-board power supply and a fairly hefty power transformer in the back left of the chassis. Electrically the HB-75 seems fairly well screened while the mechanical design has ensured that the keyboard has a solid feel by its being supported on two sturdy metal runners covered with with hard rubber pads underneath.

We were unable to assess the most important aspect of the Hit Bit package, namely the documentation in time for publication. Doubtlessly this is an important area of hardware

'Sony may well have a rush for Data cartridges on its hands despite the £30 price tag'

support to which *What MSX?* will return in future issues. Sight of the Japanese instruction manuals tells you little but it seems likely that three manuals will be supplied to the UK purchaser of the HB-75. One will be a start-up manual with a simple explanation of hook-up, the keyboard and possiblities with the **SHIFT**, **GRAPH** and **CTRL** keys. A manual for the firmware will explain the use of the Address,



The design approach is consistent throughout the system, making for a very attractive package



The Data Cartridge package—the fast data option



The keyboard is pleasantly sloped for a good typing angle

Schedule and Memo files. A third manual will offer a guide to MSX BASIC though Sony could well do to adopt a more adult approach than the one shown in the current Japanese issue manual.

Sony will lose out too if it doesn't offer hints and tips for advance programming in the manner of the Spectravideo manuals, already available in good English with ready to run programs. Some help with machine code programming would open up the MSX system to games merchants who would be delighted to get inside its large memory. Simpler graphic and sound manipulation explanations with example programs would also be a great help.

The features MSX BASIC has to offer over and above the

LIKES

- On-board software
- Keyboard quality
- Disc drives from day one
- Data cartridge

other 'dialects' of the BASIC language are precisely the areas which have been left out of the manuals so far seen from Sony. Apparently an advanced manual will be available but it seems likely that this, like the JVC 'bible', will be a 'for sale' item and not a standard issue with the machine package, mores the pity.

Sony has shown the rest of the field that the MSX specification need not be the last word in the design of an MSX computer but that it should be the basis around which an innovative product can be constructed. The standard should be taken as a recommended minimum not as a complete design brief.

Other Sony computer products will be available from the October launch date including

DISLIKES

- Cursor keys
- Small function keys
- Manual presentation

a 3½inch disc drive and interface card. The Sony drive has already been accepted as the standard to which other MSX producers will be expected to work but despite this the Hong Kong based Spectravideo micro has already appeared with a 5¼inch drive.

Sony are obviously serious about their machine being something more in the UK than an expensive toy for the micro buyer who just wants a product with a familiar brand name on it. The data cartridge and disc drive underline the seriousness of Sony's intentions, as does the provision of an RGB output which suggest some sophisticated video peripherals are just around the corner.

Verdict

In many ways the Sony HB-75 shows what the MSX standard *could* be all about. It is innovative and well supported but it is not the cheapest of the models on the market, nor does it recommend itself in view of its rather agricultural cursor pad as the 'first and always' games machine. The Hit Bit 75 is a fairly stylish product, capable from Day One of providing a diary and address book. It's role in home organisation seems well mapped out. Sony obviously sees the video hookup and disc drive potential as putting the HB-75 in the top notch; their choice of Konami cartridges, with their unsurpassed graphics, for UK distribution will ensure for Sony a foot in the games machine market despite the machine's shortcomings here.

Sony have obviously decided that computers in general and the MSX in particular have a central role to play in our lives. And what Sony decides the world seems to end up buying!

SONY HIT BIT HB-75 £299

SPECIFICATION

CPU	Z-80A equivalent (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K MSX BASIC 16K Firmware
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	48 alphanumeric 27 Control keys Keypad cursor control
NUMERIC KEYPAD	No
VIDEO DISPLAY	
TEXT	40 characters × 24 lines 32 characters × 24 lines
GRAPHICS	Maximum resolution 256×192 pixels
COLOURS	16
SPRITES	32
OUTPUT	TV Monitor RGB
SOUND	
GENERATOR	3 channels with 8 octave range
OUTPUTS	Mono audio output (6-pin DIN) 150mV/10kOhm standard

INTERFACES	
JOYSTICKS	2 Atari Standard
EXPANSION BUS	None
CARTRIDGE PORT	2
PRINTER	1 × Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	Yes
DIMENSIONS	400×245×66mm (W×D×H)
WEIGHT	3.0kg
POWER SUPPLY	Internal, captive mains lead
FINISH	Black plastic scase, black and grey keys with white lettering
SOFTWARE INCLUDED	tba
SUPPLIED ACCESSORIES	1 video cable 1 cassette interface cable Instruction manual
DISTRIBUTOR	Sony (UK) Ltd, Sony House, South Street, Staines, Middlesex Tel: Staines (81) 61688



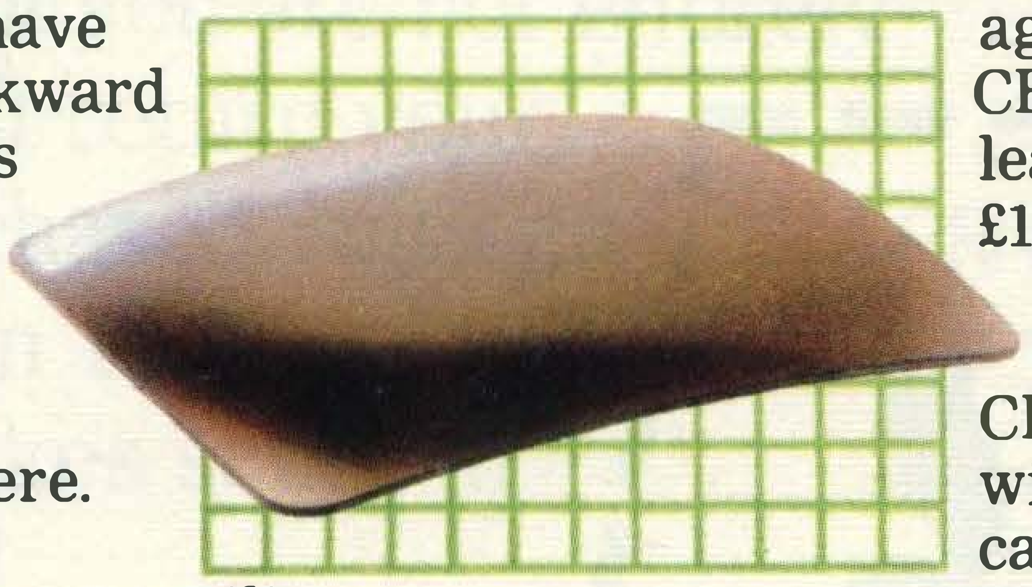
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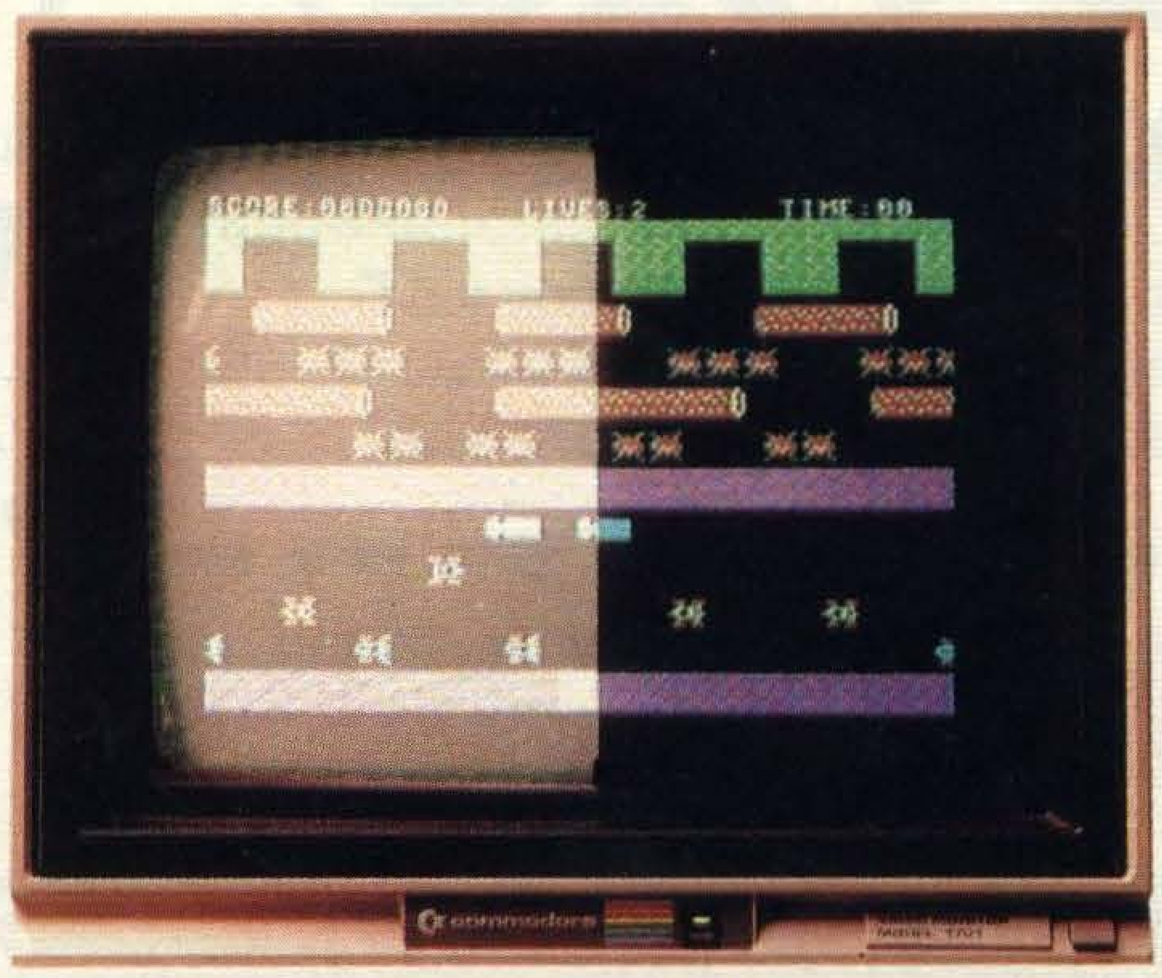


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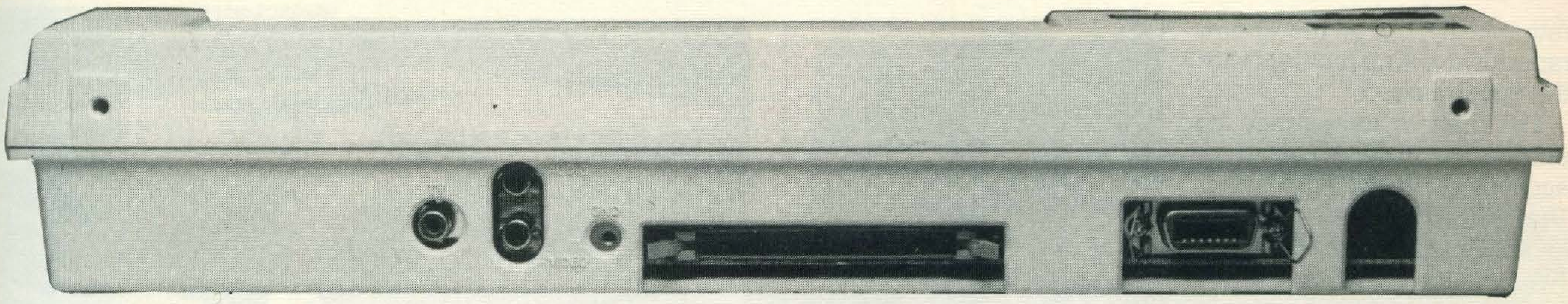
First with its micros into the UK, Hong Kong based manufacturer, Spectravideo, is offering a low-cost, pro-spec machine

Spectravideo is hardly a name to stir the blood. The presidents of major Japanese corporations lose little sleep over the activities of their Hong Kong rival. Yet, of all the companies on the MSX bandwagon, Spectravideo has the longest involvement.

Spectravideo (originally an American company) started building computers three years ago. Like almost every other manufacturer they went to Microsoft for their BASIC. The BASIC they bought was an embryonic MSX, and it went into the SVI-318 and SVI-328 computers.

When MSX was first launched, these two computers were used by many companies to develop MSX software and peripherals. Conversion from Spectravideo BASIC to MSX BASIC is comparatively easy. Spectravideo also took to developing their own peripherals and software, with a view to cashing in on the MSX boom when it arrived. The SVI-728 is their first, one of the very first, MSX computers to arrive in this country. Priced at under £250, it is one of the least expensive in the market.

The earlier Spectravideo machines gave rise to some confusion. The Hong Kong company didn't exactly go out of their way to deny that the first two models were full MSX



Lockable 50 pin expansion port on the SVI 728 has standard pin configuration but unique socket—other MSX peripherals may not fit

machines, and they built up a sizeable user base. The new Spectravideo is a true MSX computer, is not compatible with earlier Spectravideos and replaces them. There is talk of an upgrade cartridge, but there may be a wide gulf between talking and tooling.

Spectravideo's early start in the MSX race has brought certain advantages, in that the SVI-728 was launched with a system already in existence. Our computer was supplied with a disc drive, a pair of joysticks, and an 80 column display cartridge. We were thus able to run CP/M software with ease.

'The SVI 728 was launched with a system already in existence—a discdrive, a pair of joysticks and an 80-column display cartridge'

On its own, the Spectravideo is a distinctive machine. Finished in off-white and with an on-board numeric keypad, it is evident that the designers have tried to pitch their machine at a more serious market. Reasoning that many MSX customers will want their machines for more than just games, Spectravideo have decided to try and avoid the hurly burly of the games computer market.

They have also come into the market at a very competitve price. MSX computers are not going to be the cheapest around, and any that crack the £300 price barrier will be at a real advantage. Cracking the £250 mark is a bit like running the four minute mile, and is probably due to the nature of the Hong Kong labour market.

Spectravideo supply few extras in the £250 package. There is an external transformer, TV and cassette leads, plus a 200 page manual. No software is supplied. That's all part of keeping the cost down. Whether such extras are worth the higher price of other machines is a moot point.

Setting up the SVI-728 is straightforward. It has a detachable power cable complete with transformer to plug in the side, TV and cassette cables to plug in the back. Providing you have a cassette player and a TV or a monitor, you'll be able to get the Spectravideo going in a couple of minutes.

Leaving the transformer outside the computer's main casing reduces its bulk and makes it one of the smaller MSX computers.

There's a solid, chunky feel to the computer. The off-white finish and two-tone grey keys visually enlarge the casing. That numeric keyboard section also adds to the overall 'we mean business' impression.

There are a number of false keys, to the left and right of the space bar. One holds a red POWER ON light, the other serves only a decorative function. There are five oddly shaped keys too — **STOP, DEL/CUT, ESC, CAPS LOCK** and the right hand **SHIFT** key. This may be intended to highlight important keys, but it detracts from the overall appearance,

'They are not a patch on the cursor keys of other MSX computers . . . a joystick will be essential'

and coloured plastic would have worked far better. The light in the **CAPS LOCK** is useful though. An extra key provides continental accents — again a useful touch.

Arrowed cursor control keys are positioned above the numeric keypad. They are not a patch on the cursor keys of other MSX computers, and if games are your main interest, a joystick will be essential.

That numeric keypad is a novel touch. The ten digits are flanked by the four major mathematical operations, a comma, point and **ENTER**. It is unfortunate that to perform any mathematical equation, you have to preface it with **PRINT** or **?**, and press **ENTER** at the equals stage. A device to turn the Spectravideo into a proper calculator would be more than welcome, by all types of users. As it is, the numeric keypad is not as useful as it might be, and only of value if you are using mathematical or statistical programs.

The other keys suffer a little from being too cluttered. Function keys are not separated from the main keyboard. The **ENTER** keys are neither extra-large nor colour coded. **TAB** and backspace keys are marked just with arrows and if you have small hands, **CTRL/STOP** will be a two handed operation. There is no reset switch either. In short, the number of keys is to be congratulated, but they seem to have been fitted in rather too haphazardly.

The keyboard feels nice and positive, with well sculpted keys. The alphanumeric keys have a firm, slightly bouncey feel to them. The space bar is



Spectravideo's £112 80-column card fits in the cartridge slot

rather rattly, but on the whole, rapid keying is no problem with the Spectravideo.

The makers have made no allowances for non-standard accessories to be connected. The cartridge slot is centrally located behind the keyboard. Two joystick ports, marked 1 and 2, are on the left hand side of the case. The other side of the case has a large power socket and on/off switch.

The only problem with a detachable power cable is that it may be accidentally dislodged, losing hours of careful programming. Be sure to make frequent backups.

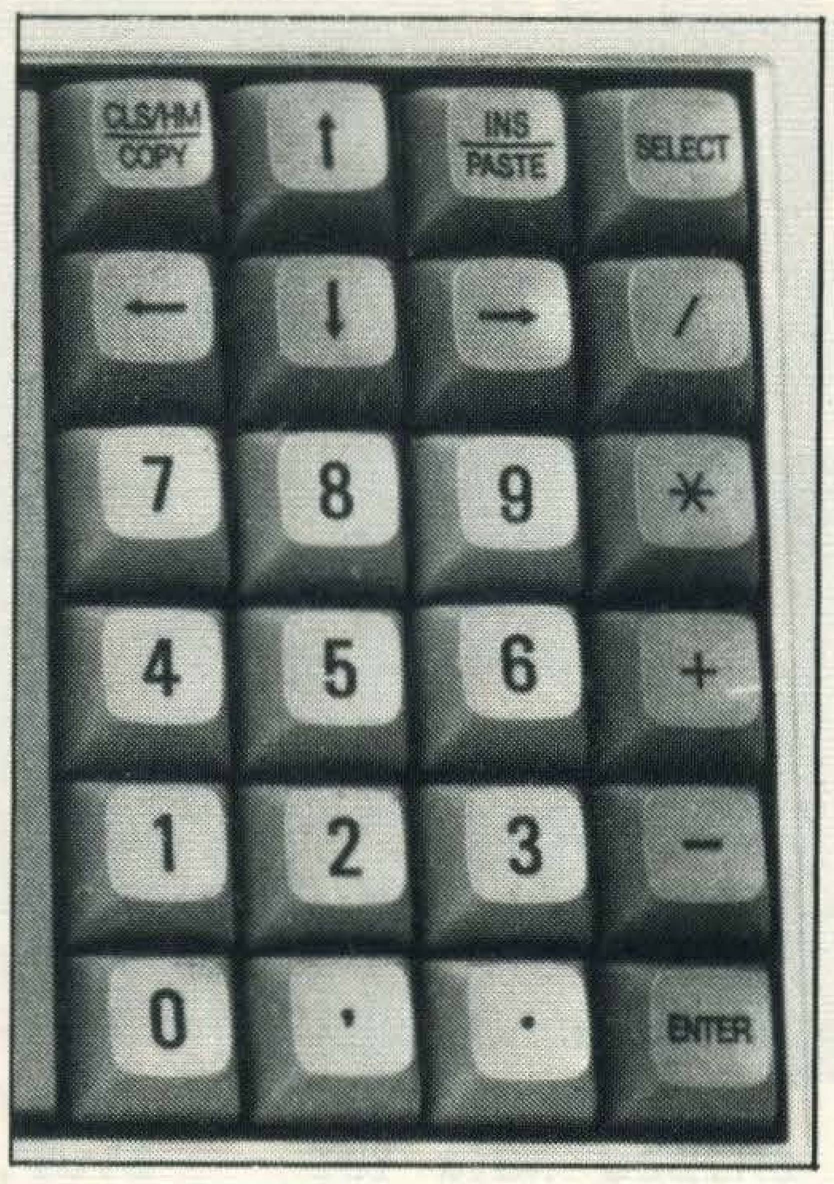
Arrayed along the back are all the rest of the interfaces. TV, Audio and Video connectors are clearly marked. There is a ground socket too, though this seems a luxury.

The 50 pin expansion port alongside has flip back locks to hold a cable in place. The printer port also has two locks, again to prevent cables coming unstuck accidentally. The final port is the standard eight pin DIN cassette port.

All the sockets and ports are clearly marked, don't vary from MSX specifications and are fully standardised. Spectravideo aren't into breaking new ground with dedicated peripherals at this early stage.

The manual supplied with the SVI-728 is quite impressive at first glance. Ring bound, profusely illustrated with diagrams and photographs, neatly layed out, it has a professional air to it. It is mercifully free of amusing translation literals too.

Assuming no prior knowledge of computing, the reader is introduced very gradually.

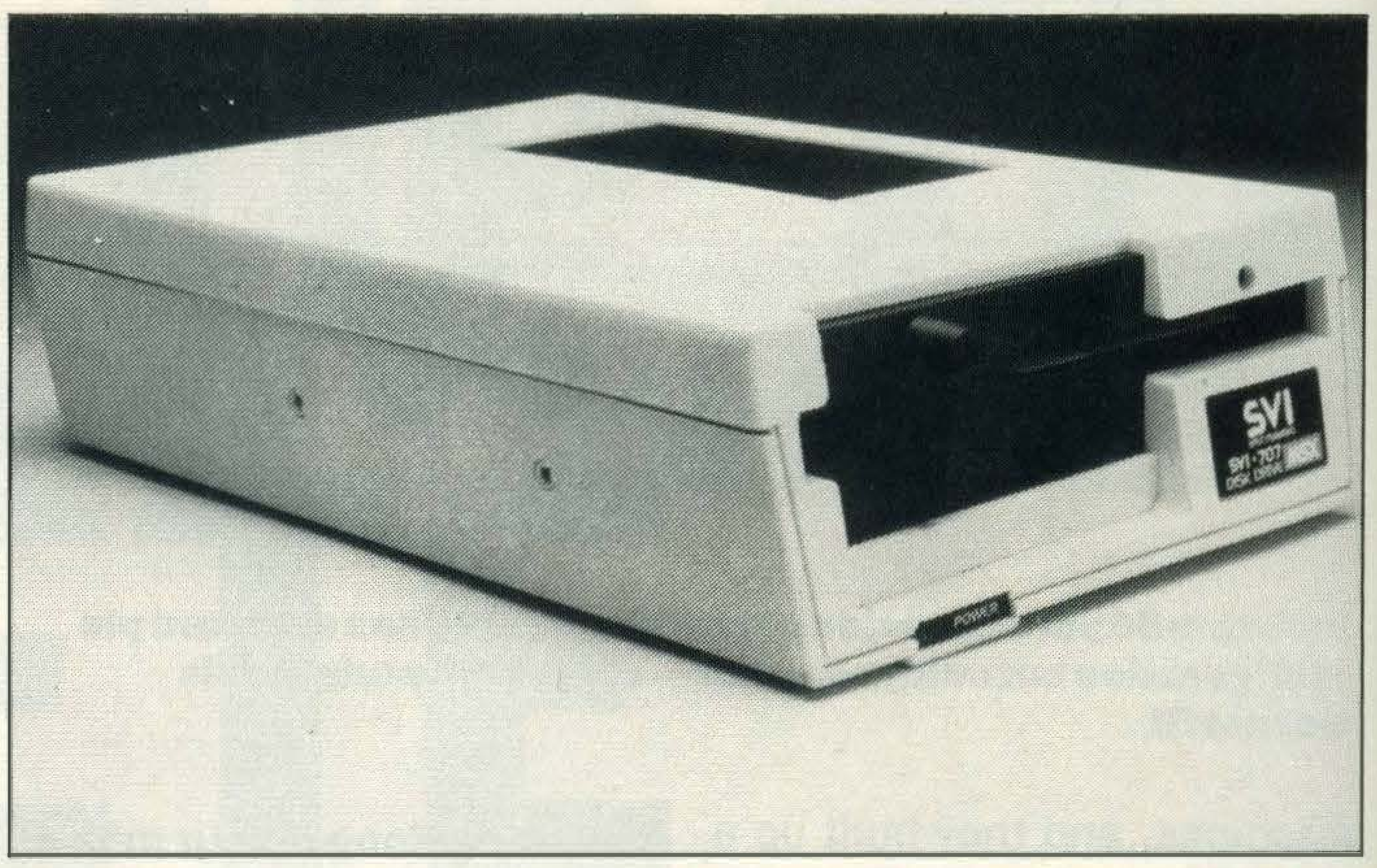


The system is explained, setting up is detailed and many pages given over to the keyboard. From there it is into a selection of BASIC command categories — program structure, random numbers, arrays, strings, editing, music and graphics.

'Text is kept plain and simple; rather patronising example programs are used'

The text is kept plain and simple; rather patronising example programs are used extensively. There is a fold out chart of commands at the back, though no itemised, alphabetic listings of all the commands and their effects.

The end result is that some program procedures and BASIC commands are introduced very well indeed. Others are glaringly absent, and the novice will almost certainly



SVI-707 disc drive (£345) with built-in controller means CP/M is ready to run — if you have the 80-column card. Left — numeric keypad

need to read further if he or she is to make the most of MSX BASIC.

There is also some repetition, particularly on BASIC graphic and sound commands. That wastes pages that could have been put to better use.

The main areas that have been omitted are mathematical functions, string handling and program recording/loading. The last item is particularly important, as buyers will probably want to load programs very early on in the piece.

So, documentation is very good as far as it goes. An advanced users manual to the same standard would be a welcome provision though.

Having the transformer separate from the computer should, in theory, give lower running temperatures. The main casing has grills on top, front and underneath, with stubby legs raising the body a few millimetres off the desk. Ventilation is well catered for.

The result is that the Spectravideo runs cooler than many of the other MSX machines. Leaving it switched on overnight won't have any disastrous consequences.

Sound and video output from the Spectravideo is quite good. The colours lack the luminosity of some of the other computers, such as the Sony and Mitsubishi. The sound lacks the bell like clarity of these computers too. By comparison, it is not a star performer. Still, for the home computer user, the sound and picture quality will depend more on the monitor or television used, the SVI-728 has all the usual excellent MSX graphics.

We had the opportunity to try out some of the Spectravideo peripherals too. The eventual Spectravideo range is to include an RS-232 cartridge, a modem, data recorder, 80 column cartridge, disc drive and joysticks. It will be a pretty comprehensive system.

Part of that system is the £345 SI-707 disc drive. Styled in the same off-white as the computer, it is a relatively standard 5.25inch disc drive.

The unit is a double sided, double density, 40 track type. 80 track formats are more common. Still, an unformatted disc will hold 500K of data

'Leaving it switched on overnight won't have any disastrous consequences'

reduced to 256K when formatted. Access time is less than one-tenth of a second.

The drive interfaces to the 50 pin port on the back of the Spectravideo SVI-728. The port has a single, central cutout that mates with a single lug on the cable from the disc drive. Other computers have two cutouts, so to fit the SVI-707 drive to say a Sanyo, you will have to cut off the lug. It is a sign that standardisation is not quite all that it might be.

The power cable can be disconnected from the disc drive. There's an on/off switch at the back and a power on light at the front. Apart from a lever to lock in the disc (you can't set the lock if there is no disc inserted), there are no other controls. A grille on the top plate provided much needed ventilation.



Twin button MSX joysticks — buttons can have different functions

LIKES

Good value for money
Available peripherals
Numeric keypad
Manual



The 728 is based on the earlier 328, with an MSX standard cart port and 'real' BASIC

Operation is as you might expect of a modern disc drive — fast, not too noisy, and reliable. With few other MSX disc drives to compare the Spectravideo offering to, it is difficult to make any other comments than this one does a good job without breaking new ground, but unfortunately at quite a high price.

The 80 column cartridge costs around £112. It plugs into the cartridge port on the top of the computer. You must already have the disc drive connected to access the 80 column display.

With the computer/drive/80 column cartridge set-up, you can run CP/M programs. They need an 80 column display, and thus will stretch your monitor to the limits. You will be able to run all manner of sophisticated business programs and really make your MSX computer earn its keep.

You can, of course, revert to normal 40 column display at any stage. That is the extent of what the 80 column cartridge does. If you want to run CP/M software, it is essential. If not, it is an expensive luxury.

The Spectravideo joystick is a well designed accessory. It costs around £12; previous models are already well established in the market. Two fire buttons, a sculpted handle, eight movement directions, suction pads on the base — it has all you could want. Movement is limited and the action a little stiff compared to other sticks we've tried but the SVI sticks took all the abuse our office staff could hand out.

Other components for the Spectravideo have yet to appear, but given the range thay made available for their earlier machines, we can expect a steady flow of interesting accessories.

Given this kind of support, the fact that Spectravideo is not a well known name is no drawback. They have a readily available system and a computer at a reasonable price.

DISLIKES

Keyboard layout
Cursor control keys
Image quality

Verdict

Compared to some of the more expensive machines from better known companies, the SVI-728 is not without its drawbacks. It is more a business than a games machine, and that may restrict its market. To get it up and running CP/M software, you will have to spend over £700. The outfit will be quite a bit less expensive than a 'proper' business machine, and for that reason Spectravideo's marketing strategy may pay dividends.

For the home market, the major attraction of the Spectravideo is the price. You don't get the freebies with it, but the initial outlay is lower. If you are after an MSX machine, on limited funds, the Spectravideo may appeal. Look at some of the other machines first and decide. If a few extra pounds may not bring a better computer.

SPECTRAVIDEO SVI-728
£250

SPECIFICATION

CPU	Z-80A equivalent (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K expandable to 96K includes 32K MSX BASIC
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	64 alphanumeric 25 control keys Standard key cursor control
NUMERIC KEYPAD	Yes
VIDEO DISPLAY	
TEXT	40 characters × 24 lines
GRAPHICS	Maximum resolution 256×192 pixel
COLOURS	16
SPRITES	32 independently programmable
OUTPUT	TV Monitor
SOUND	
GENERATOR	3 channels with 8 octave range
OUTPUTS	Mono audio output (RCA phono) 150mV/10kOhm standard
INTERFACES	
JOYSTICKS	2 Atari standard
EXPANSION BUS	1 × 50 pin
CARTRIDGE PORT	1
PRINTER	1 × Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	No
DIMENSIONS	405×215×72mm (W×D×H)
WEIGHT	2.3kg
POWER SUPPLY	External transformer
FINISH	Cream plastics case, grey keys with black lettering
SOFTWARE INCLUDED	None
SUPPLIED ACCESSORIES	1 video cable 1 audio cable power supply instruction manual
DISTRIBUTOR	Spectravideo Ltd, 165 Garth Road, Morden, Surrey SM4 4LH Tel: 01-3300101

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Eager to be the first into the field, Toshiba has been pushing its £279 HX-10 micro hard with a full range of add ons

Toshiba is a familiar name. But until now you're more likely to have come across it while cooking the Sunday roast, or watching a movie, rather than running a program.

That's because the company is a market leader in microwave ovens, although its main revenue comes from televisions, video and hi-fi. Indeed, Toshiba is the third largest manufacturer of television tubes in the world.

The company is also a big name in the semiconductor industry, designing and manufacturing their own chips. And this technology finds its way into many of their other, larger scale products — from power stations to satellites, via locomotives, elevators and air-conditioning units. It's all a very long way from Toshiba's humble origins in 1875, making telegraph apparatus.

It seems likely that the 64K Toshiba HX-10 will be one of the first and most numerous of the MSX machines. That will provide an enviable prominence in the market, although Toshiba say that it's not by design — their machine just happened to be ready. In fact,

quite a lot of them are ready, and Toshiba expect it to sell in large numbers by Christmas, even if they were a bit cagey about exact figures.

It is going to be a very well-supported launch, with Toshiba producing a joystick, data recorder and two printers at the same time as the machine.

Unlike many of the MSX computers, the HX-10 is not aimed at any specific market. Nor does it have any special features dedicated to particular applications, unlike the Yamaha music computer, or

'HX-10 will be one of the first and most numerous of the MSX machines'

the JVC and Pioneer models with both their special video extensions.

Toshiba is instead aiming the machine at all home users, with the emphasis initially on games. That's not because the keyboard is designed with games in mind, but simply that games are the most popular use for a computer at the moment.

So the HX-10 is strictly middle-of-the-road. And that's reflected in the design, which is unexciting, unimaginative, but solid and business-like.

It's a bit of a box—very squat and square, with no real sloping of the keyboard. I found typing slow and tricky, although you would probably get used to it after a while, especially if it's your first computer and you're not accustomed to anything else.

The styling is also fairly bland, the main box being a sober dark grey, with the keyboard having a lighter grey surround.

The appearance is brightened up somewhat by the keys. Toshiba chose white for the main character keys, with nar-



Part of Toshiba's big peripheral build up—the HX-P550 80-column dot matrix printer

row black letters. It's easy to read, even in relatively low light. But I wonder how long it will take before the keys start looking a little scruffy.

Most of the control keys are in mid-grey with white lettering. That means that the character keys are clearly outlined, which is useful when you have to do a lot of typing.

There are a few keys which don't conform to the general colour scheme. At the top right of the main keyboard area is a

'It's a bit of a box—very squat and square, with no real slope to the keyboard'

large red STOP key. In spite of its size, you're unlikely to hit it by accident.

The **GRAPH** key, between the space bar and **CAPS** key, is in bright green. That makes it fast and easy to find, which is useful if you're entering a large number of graphics symbols into a program.

The other colour on the keyboard is blue. This time it's the cursor keys, arranged in the usual cluster in the bottom right-hand corner.

The overall effect is reasonably clear and uncluttered. Even when new to the machine, you can start typing without too much hunting around for symbol keys.

But it's not just the look of the keyboard that's important. For applications like word processing, the feel and size of the keys is just as important.

The keystroke is a little shallow and lacking in resistance for my liking. And the keytops are very flat and fairly small. All this meant that it was some time before I got down to my normal diabolical level of typing errors.

In fact, my main complaint is to do with the size of the keys.

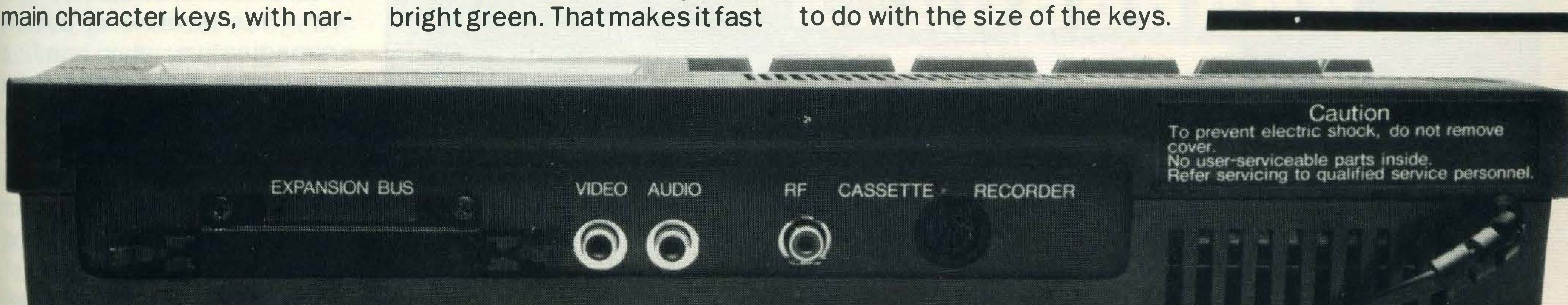
'Keystroke is a little shallow, lacking in resistance for my liking'

The backspace is much too small for something that is used so often. I found myself hitting **RETURN** by mistake.

Similarly, the two key clusters on the right of the keyboard — the editing and cursor keys — are quite cramped, so it's quite easy to make a mistake.

On the plus side, however, the function keys are a good size, and well placed. And the **RETURN** key is certainly large enough.

The remaining features of the keyboard are two LEDs. A red light at the top left indicates power on. A green LED below the **SHIFT** and next to



Standard MSX input/output array but Toshiba have fitted a screw-on dust cover to their lockable 50-pin expansion bus

CAPS, tells you when the caps lock is on.

Both lights are slightly recessed but very clear. There's another recess, this time without a light in it, on the right of the keyboard, near the cursor and £ keys. I would assume that this was probably used with the kana character select key on the Japanese version of the machine.

The Toshiba provides the standard set of sockets. The cartridge slot is on the top right. Pushing down the sprung cover you find that the inside of the slot is encased. This stops dust getting through the slot into the computer — a thoughtful piece of design.

'Toshiba include a 50-pin expansion bus rather than a second cartridge socket'

For the rest of the sockets you have to move on to the sides of the machine. On the right are the two joystick ports and Centronics printer socket. All of them are the standard MSX types.

The left side just has the **ON/OFF** switch, so the rest of the ports are on the back. These are pretty much as standard too.

There's a DIN socket for the cassette interface, and phono sockets for the RF and composite monitor video and audio outputs.

Toshiba has decided to include a 50-pin expansion bus, rather than a second cartridge socket. This is a sensible decision, as it gives a choice of connection devices. If you do want another cartridge port, it shouldn't be too long before someone brings out an adaptor.

All sockets are clearly labelled, which is particularly useful in the case of the composite audio and video outputs as both sockets look the same.

One other thoughtful feature is the inclusion of a cover on the expansion bus socket. This is a metal plate, held on by two screws. Not only does this keep the dust out, but it also protects the pins.

The last main visible feature, which at first appears to be just part of the styling, is the large grille on the top. In fact, there are more grilles on the bottom, side and the back of the casing.

The grilles are there, of course, to help keep the machine cool. Having an onboard power supply unit can sometimes cause overheating problems. But the Toshiba doesn't seem to suffer too badly from this.

'The documentation is pretty good which makes a change for home computers'

Looking inside the computer, you can see how the power transformer is kept well away and shielded from the main printed circuit board (PCB). What's more, there is a large heat sink attached to the PCB, helping to keep the temperature down.

The keyboard is securely screwed into the top half of the case, with full-length metal strips holding it in place. Indeed, the whole thing is very solidly built.

There's a lot of space inside the box. The main PCB takes up about two-thirds. The rest contains the power transformer and the UHF modulator.

So that's the machine. But it doesn't come on its own. In the box you will find a cassette lead, TV lead, sample tape as well as two manuals.

The documentation is pretty good, which makes a pleasant change for home computers. The first, thinner manual is called the Owner's Manual. This takes you through setting up the machine, use of the keyboard and basic BASIC. There's also a list of error codes and character codes, but for that level of detail you really want the second manual.

The Toshiba MSX BASIC Reference Manual is one of the best we've seen. There are chapters on programming and editing techniques; constants, operations and functions; graphics and screen control; sound; files; interrupts; and machine code.

Key words

In addition, each BASIC key word is fully explained, with syntax and examples. It's not exactly a teach-yourself-BASIC book, but it certainly provides enough information to keep you going for some time.

A few of the program examples in the manuals are slightly dodgy. We had to de-bug a few before we could get them to work. But in general, the manuals are well laid out, comprehensive and informative.

As for the software, which comes on the sample tape, there are no real surprises. It is pretty similar to the software provided by some other machine manufacturers — which isn't all that odd considering it's written by the same person.

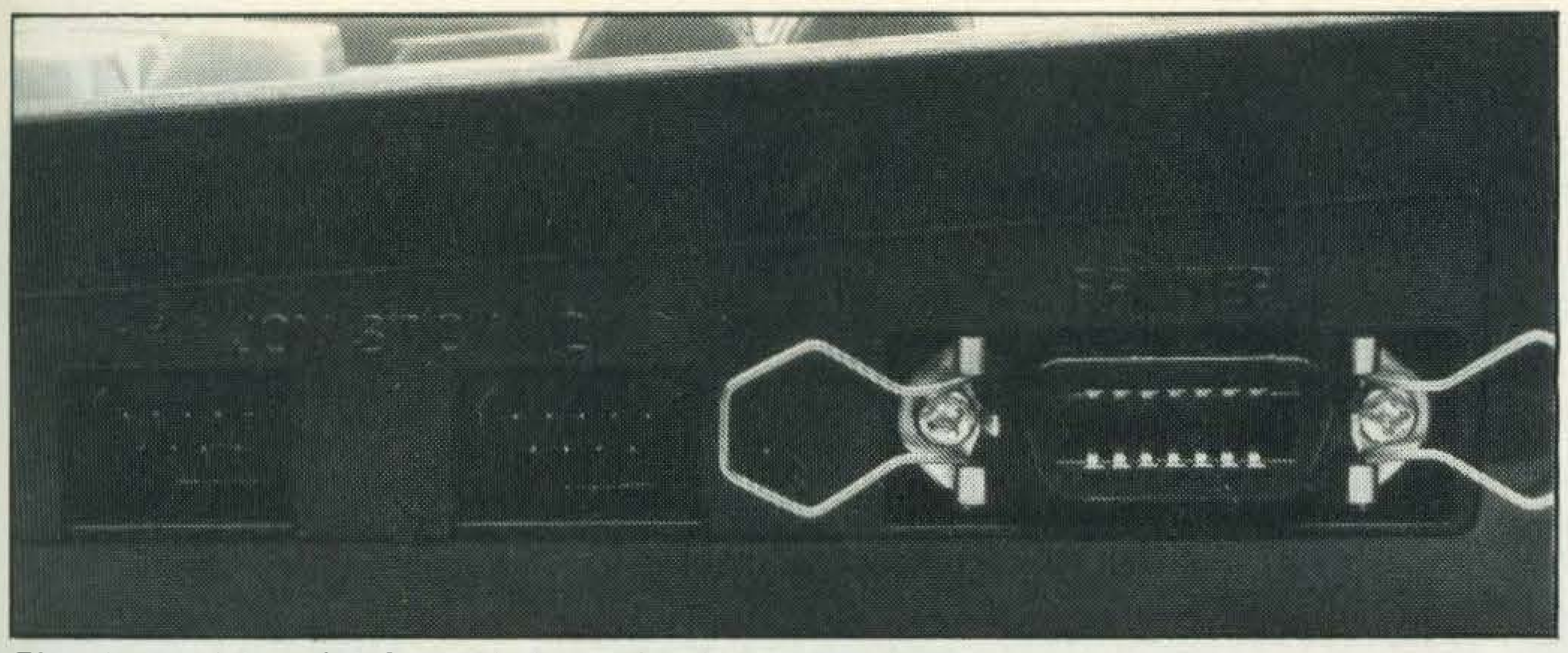
'A few of the program examples in the manuals are slightly dodgy. We had to debug a few before we could get them to work'

To start with, you get a demonstration program outlining the peripherals and specifications of the Toshiba system. This is done in a fairly unimaginative way, and it could have been done much better in the manual. But at least you are told what else is on the tape, and there is also a moderately useful colour chart, for checking the tuning of your TV.

The next demo program shows the character sets, some graphics demonstra-



Both the printer Centronics interface and the Joystick ports are on the right panel



The right side with joystick and printer sockets

tions (line drawing, shape filling, graphs, and the like), and some idea of what the machine is capable of in the way of maths, music, sound effects and business programs.

Graphics are taken slightly further in the next program, with some pretty patterns being drawn on the screen. But I don't know why this fairly insubstantial program couldn't have been included in the previous one — it would have saved loading time when running through the tape.

Next comes a keyboard trainer. This certainly won't turn you into a 100 words per minute touch typist as it gives no guide as to which finger should hit which key. It may help people who haven't used a keyboard before to find out exactly where the various keys are hiding.

LIKES

Reasonable price

Good documentation

Well supported

The program works by showing a graphic representation of the keyboard. One key at a time flashes — this is the key you have to press. At the end you are given a score and a time, with a pertinent comment.

Lastly, there is a maths test, giving a choice of addition or multiplication. This has the best graphics of all these programs.

All the software is listable. Indeed, you are encouraged to LIST and study the programs in order to learn programming techniques. It isn't the highest quality software around, and doesn't really use the machine's facilities to the full, but it'll keep the rest of the family amused while you read the introductory manual.

That's what comes in the box. But as mentioned before,

DISLIKES

Poor key response

Uncomfortable design

Cursor, editing and backspace keys too small

Toshiba is launching a few interesting peripherals at the same time as the machine.

The joystick is the same model adopted by many of the other manufacturers, including JVC, Canon, and Sanyo. Originally Toshiba was going to charge more than some of the others for the joystick, but 'market forces' (Sanyo — *who's he? Ed.*) have brought the price down to £12.95.

The data recorder looks a little like a personal stereo. A price wasn't available at the time of writing.

For those who like hard copy, there are two printers. The HXP550 is a fairly standard dot matrix, at £349.95. But what's more interesting is the HXP570 four-colour plotter printer. This compact machine takes A4 or roll paper. The colours are provided by four pens in a rotating mount, which move from side to side. Plotting is achieved by moving the paper back and forth.

This excellent little machine will sell for around £250, including cable, paper roll holder and the necessary controlling software.

Verdict

So what's the verdict. Well, the HX-10 isn't the most exciting MSX computer. But at around £280 it's reasonably priced for a 64K machine. And many people may regard price as being more important than the finer details of design.



Fair layout and good quality keys make the Toshiba HX-10 cursor key pad one of the best for keyboard games playing

TOSHIBA HX-10 £279

SPECIFICATION

CPU	Z80A equivalent (3.6MHz clock)
MEMORY	
RAM	64K
ROM	32K MSX BASIC
VIDEO ROM	16K
KEYBOARD	
TYPE	Full travel
KEYS	48 alphanumeric 25 control keys Keypad cursor control
NUMERIC KEYPAD	No
VIDEO DISPLAY	
TEXT	40 characters × 24 lines 32 characters × 24 lines
GRAPHICS	Maximum resolution 256 × 192 pixels
COLOURS	16
SPRITES	32
OUTPUT	TV Monitor
SOUND	
GENERATOR	3 channels with 8 octave range
OUTPUTS	Mono audio output (RCA phono) 150mV/10kOhm standard
INTERFACES	
JOYSTICKS	2 Atari standard
EXPANSION BUS	1
CARTRIDGE PORT	1
PRINTER	1 × Centronics
SERIAL PORT	No
CASSETTE	8-pin DIN
RESET	No
DIMENSIONS	370 × 245 × 60mm (W × D × H)
WEIGHT	2.8kg
POWER SUPPLY	Internal, captive mains lead
FINISH	Two-tone grey plastics case, white keys, black lettering, colour cursor, stop and graph keys
SOFTWARE INCLUDED	1 cassette, 5 programs
SUPPLIED ACCESSORIES	1 video cable 1 cassette interface cable Instruction manual BASIC manual
DISTRIBUTOR	Toshiba (UK) Ltd, Frimley Road, Frimley, Camberley, Surrey GU16 5JJ Tel: (0276) 62222

COMING SOON TO YOUR SCREEN

More MSX machines are on their way to this country. We've been previewing offerings from Yamaha, Goldstar and Mitsubishi

Over thirty different companies are thought to have applied for or bought a licence to produce MSX computers. Not all of them are Japanese and you can expect to see a number of computers from countries such as Taiwan, Korea and other centres of low-priced consumer electronic goods. The Korean made Goldstar is an important 'taster' for what is to come.

Don't scoff at the fact that it is not made in Japan. The Goldstar company is no back street outfit — they're big, very big. They've implemented the full MSX specifications too, ably demonstrating the benefits of having a standard.

Being a full MSX machine, the Goldstar has just the same facilities as its more expensive Japanese rivals. It has 64K of memory, full MSX BASIC, the 16 colours and 32 sprite graphics, three sound and one noise channels, Centronics printer interface, PAL output and so on. It is much the same as other MSX machines.

Physically it is very similar too, with the differences being purely cosmetic. The keyboard has a full complement of 47 alphanumeric keys and 25 control keys, with a cursor keypad to the right of the keyboard proper. Function keys are above the main keyboard, everything else is where you are used to seeing it.

The keyboard has a Toshiba-like appearance, with blue cursor control keys, a red STOP key and green CODE and GRAPH keys. The keys aren't engraved with letters (they are painted on in black) and there is a springy feel to the keyboard. As MSX keyboards go, this one is not particularly good for someone intending to do word processing or enter large amounts of data.

The cursor control keys work well enough, being close together for easy switching and quite responsive.



Korean Goldstar FC-80 MSX micro — a full spec machine with light pen holder and good demo program

Two features are worth noting. The Goldstar has a socket to accommodate a light pen, and a green LED that lights up when the CODE key is pressed. Both are useful extras.

'The Goldstar has just the same facilities as its more expensive Japanese rivals'

Interfaces are standard. Two joystick ports are found on the right hand side of the casing, next to a DIN cassette interface. There is an ON/OFF rocker switch on the back, above the permanently connected power supply cable.

The video, audio, TV and printer connectors are arrayed along the back. Next to them is a 50-pin Input/Output port, like the one on the Spectravideo. There's just one cartridge port.

Large areas of grille are found underneath the computer, with more grilling on the top. Even so, the Goldstar seems to run rather warmly.

All this pales into insignificance when you learn the price though. At less than £240, the Goldstar is a positive bargain. It will do exactly the same as MSX computers costing considerably more, take exactly the same software and peripherals, yet leave you with something in your pocket. We'll have a full review next issue, but if this is the sort of competition that Sony, Canon and others are going to have to face, they can't afford to be too complacent.

In the next issue we'll also be reviewing the Yamaha CX5M music computer. We've already had a preview of its capabilities, and if you are musically inclined, it's magic.

The asking price is £600. That's twice as much as any other MSX computer. However, Yamaha's marketing emphasis is different. They are selling the CX5M as a sophisticated synthesiser with an on-board MSX computer, rather than an MSX computer that makes fancy noises too. That's why you'll only be able to buy the CX5M in musical instrument form at first.

'This outfit matches synthesisers costing considerably more, and without an MSX computer'

The £600 kit contains more than just the MSX computer. It also contains a plug-in 29 note keyboard, an eight-note polyphonic synthesiser and cartridge-based program to control the synthesiser. In facilities, this outfit matches synthesisers costing considerably more, and without an MSX computer.

The computer itself is a 64K machine with a full-travel keyboard, cursor control keys, MSX BASIC and all the MSX interfaces. It will operate just as any other MSX computer, taking the same software and accessories. That's not what the CX5M will be mostly bought for though.

The synthesiser unit and keyboard attach to the bottom of the computer when a large panel is removed. There is a special interface not found on any other MSX computer. At this stage, Yamaha have no plans to make adaptors so that their music attachments can be used with other makes of MSX computer.

The attachment has stereo outputs. To make the most of the sound, connect the unit up



A proper piano-style keyboard is part of the £600 Yamaha CX5M outfit — more a synthesiser with an MSX computer

to an amplifier. There's no reason why musicians shouldn't use the CX5M for concerts, through PA systems.

The keyboard has full size keys, with the feel of a small electronic organ. An optional extra is a 3½ octave piano style keyboard.

With the keyboard connected, all you do is play. Up to eight notes sound simultaneously. It is exactly the same as playing a synthesiser.

Volumes

The beauty of a synthesiser is that you can alter the sound of the instrument. That's the task of the supplied cartridge. To explain what it does in detail would take volumes. Basically, it allows you to select any sound from a list of 48. These sounds are as common as guitar, piano, violin, or as unusual as cowbells, koto or bird tweets. With a suitable recording set-up, you can generate every part of a musical composition from the one machine. You'd only have to add your voice.

The monitor is used to display the options available to you. Good use is made of the normal graphics available through MSX.

Yamaha have more than this stunning combination available. One accessory program, to cost around £50, is a Music Composer. This allows you to compose music on screen, using the keyboard and all the facilities of the synthesiser. You can program up to eight musical parts, each with a different instrument. You can play back your results. You can repeat sections, change time signatures, edit bars, use the thing to write music almost as you would use a word processor to write text. Compared even to Yamaha's most sophisticated musical synthesisers, this little package is fantastic, and should be much sought after by musicians of all types.

There's another cartridge program for the CX5M too —

> **'This little package is fantastic and should be sought after by musicians of all types'**

Music Macro. This is a utility program that lets you incorporate sounds created on the synthesiser into BASIC programs. You could use them for games, sound effects, educational purposes, and much more. It all adds up to make the CX5M a dream machine for musical MSX buffs.

The high price of the outfit is a minus point. However, if you compare it to the price of similarly specified synthesisers, it is surprisingly good value for money. It is an expensive MSX computer, a good value for money musical instrument. The next *What MSX?* will have a full report on the Yamaha CX5M while *MSX Computing* will be getting a well-known musician to review the full system.

Difference

We'll also be featuring the 48K Mitsubishi. It is the first non-64K machine in the UK and priced at an attractive £250. The finish is different to its 64K namesake, but it has exactly the same MSX BASIC, the same graphics and sound abilities, the same interfaces and so on. The only difference is the smaller amount of memory. This means that programs needing a great deal of memory to run (the most sophisticated games and so on) may not be compatible, and you won't be able to get as much data into a word processor, data base or spreadsheet package.

In Japan, machines with 48K or less memory are very common and quite accepted. To find out how a 48K machine stacks up in the UK scene, be sure to get the next issue of *What MSX?*



Mitsubishi's 48K MSX will sell for less than £250

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EXTENDED BASIC– FIRST REPORT

Tom Sato reveals the features of Microsoft' extended basic



When Microsoft was planning the MSX standard nearly two years ago, it was determined that the BASIC should be the best in the world. Even though Microsoft has been a market leader in off the shelf BASIC packages since the late seventies it's lately been criticised for being out-of-date in the face of current fierce competition from other companies. So when it rewrote Microsoft BASIC (Version 4.5) for the MSX standard, there were many changes; a whole array of new commands and vastly improved arithmetic.

If you have used the old Microsoft BASIC, one of the first things you'll notice with MSX BASIC is the absence of that notorious line editor and the addition of a full screen editor. This means that you can make corrections to your program anywhere on the screen by moving the cursor to the relevant position and typing the correct characters. The whole editing process is so simple that it won't take more than five minutes to learn how to edit.

MSX BASIC features all the advanced editing commands such as automatic line numbering, partial renumbering and block deletion. The error messages are in plain English and easy to understand, unlike other machines which give error codes. All these editing features give you the best possible environment for writing BASIC programs.

This BASIC also features many of the 'advanced' statements standard on upmarket home micros like the BBC. You can have multi-statement lines and multi-dimensional arrays. The IF THEN construction has the ELSE option, and all the logical operators such as AND, OR, NOT and XOR are also included.

However MSX BASIC's strong point lies with its superb graphics capabilities. There is little or no doubt that MSX BASIC's graphics are some of the best, save on expensive business micros. This is entirely due to a sensible choice of the Video Display Processor chip called TMS 9929A, which is found in every MSX micro.

Let us see what this video chip can offer. First off it gives you a choice of four display modes; two text modes and two graphics modes. The default screen mode, i.e. the screen mode selected on power-up of the machine, is MODE 0. This mode is 37 characters wide and has 24 lines.

Mode 1 is a low resolution text mode with a line width of 29 characters. However, this text mode has the advantage that sprites can be used.

Mode 2 is the high resolution graphics mode. It provides a resolution of 256 by 192 pixels but unlike the BBC Micro, which has only 8 colours, the MSX has 16 colours which gives you more scope in using computer graphics. The fourth mode is the multicolour low resolution mode which gives you block graphics.

The graphics do not use up any user RAM because the video chip has its own built-in RAM. This means that the programmer doesn't need to worry about using up user RAM for graphics.

Another great feature of the Video Display Processor is the fast moving sprite graphics. These sprites are small graphics characters which can be displayed in front of the main background screen display without disturbing it. Programming Space Invaders in BASIC is made possible with this sprite facility.

There are four sprite sizes; 8 by 8 pixels unmagnified, 8 by 8

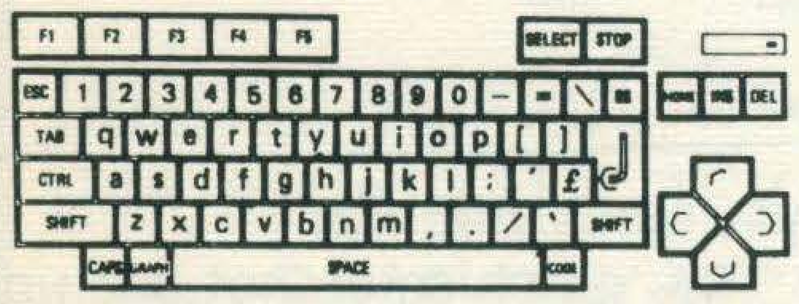
magnified, 16 by 16 unmagnified and 16 by 16 magnified. You can use one of 16 colours for each sprite and place them anywhere on the screen.

The sprite operation is very fast and flicker-free with a full wrap-around facility so that if a sprite goes beyond one edge, it appears on the other side. It is possible to alternate from one sprite pattern to another so that cartoon animation can be very easily achieved. It is possible to simulate a multi-colour sprite by overlapping two sprites and moving them close together.

The appeal of MSX BASIC's sprites is that they are extremely easy to use, unlike those on the Commodore 64 or Vic 20 whose use entails endless POKEing of numbers into various memory locations. Microsoft, on the other hand, has given MSX BASIC two simple commands; PUT SPRITE to place a sprite onto the screen and SPRITE$ to define a sprite.

You can expect a wide range of drawing commands such as LINE, PRESET, PSET, POINT, CIRCLE and PAINT. Each graphics statement has several options. For instance, LINE can draw rectangles and squares with the option to fill it in any colour, as well as straight lines, while the CIRCLE command can draw ellipses, arcs, pie charts — all with colour options too.

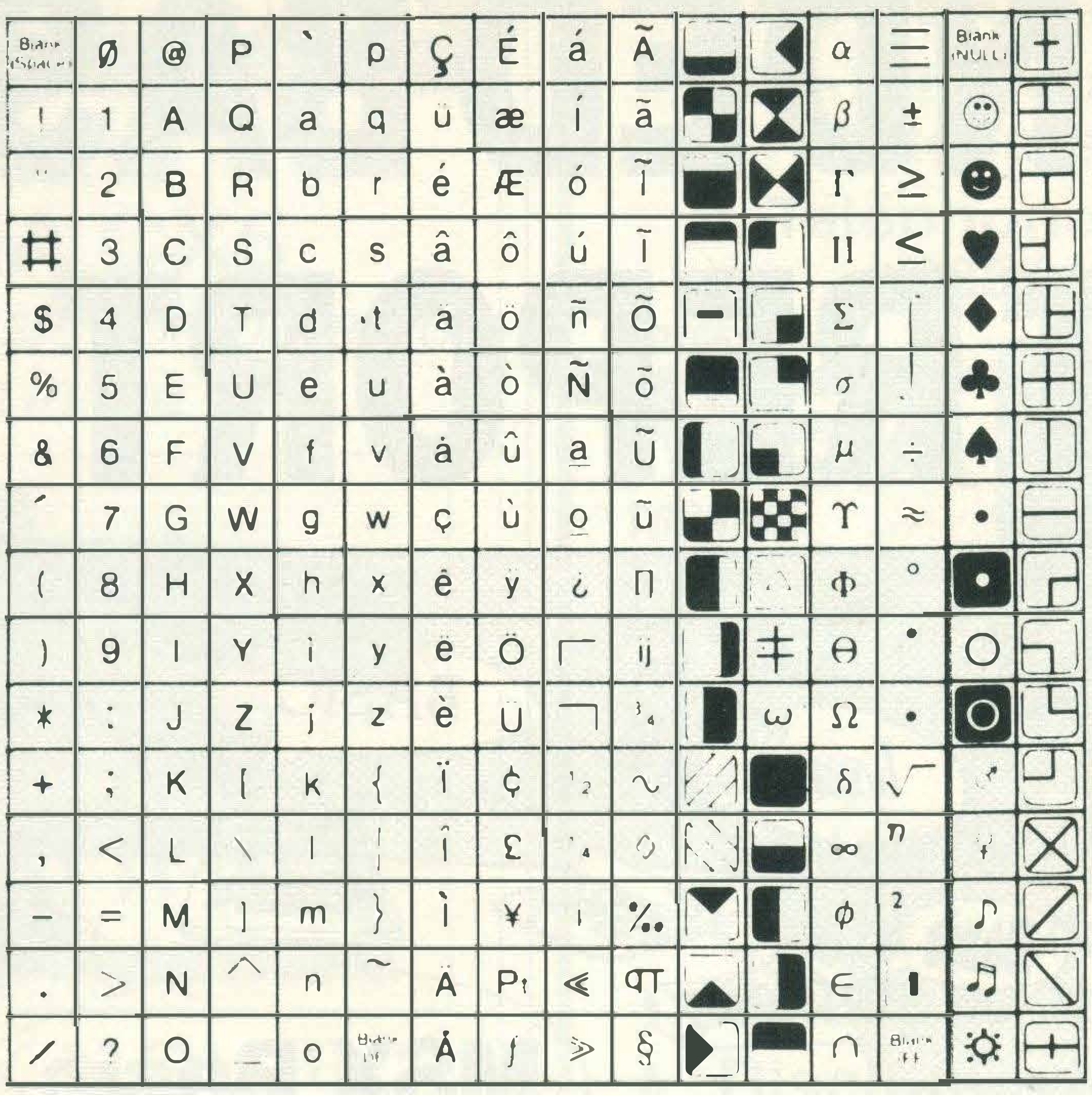
If you want to draw even more complex shapes, use the DRAW command. This command uses the Graphics Macro



Language (GML) with which you can draw detailed patterns with simple instructions like U, D, L, and R for drawing lines up, down, left and right.

GML is quite comprehensive. Within it, you may change the colour of a drawing, change the scale, move to a different part of the screen, draw diagonally and can even draw the same shapes repeatedly in different sizes.

When you look at the sound facilities of the MSX, they are just as exciting as the graphics. You can play music using the PLAY command and the Music Macro Language, and generate sound effects



using the SOUND command. The SOUND generator will allow you to use up to three channels with the option of using the special enveloped wave form of the built-in noise generator.

The Music Macro Language, as you've probably guessed is the musical equivalent of the Graphics Macro Language. All the notes on the piano can be played using the MML and you can play three channels at once. Also, the sound can be shaped in the same way as the SOUND command so it is possible to play music with the sound of, say, a flute.

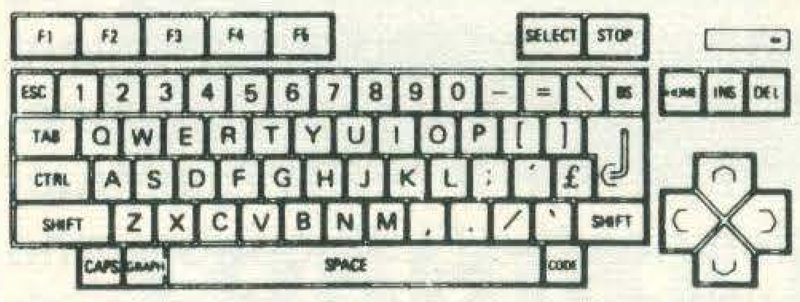
MSX BASIC supports five function keys, each doubling up by use of the SHIFT key. When you are in the text mode, the bottom line is devoted to displaying the contents of the function keys as a reminder. Only five are displayed, the other five being displayed when you press the SHIFT key. If you don't want to see the function key lists, say, when a program is running, you can simply turn it off using KEY OFF. KEY ON will switch it back on.

When the computer is switched on, the BASIC automatically defines the function keys to the most commonly used commands such as LIST and RUN although these can be changed using the KEY statement. The maximum character length a function key can hold is 15. It is possible to include control codes for commands like the RETURN key and clear screen function within the function keys. There is a LIST command called KEY LIST which gives a listing of all ten function keys.

All the standard string functions are featured in MSX BASIC. These include LEFT$, RIGHT$, MID$, STRING$, STR$, INSTR, and LEN. It is also possible to compare two string variables.

On the maths side, MSX BASIC has SQR, LOG, SIN, COS, TAN, and ATN functions to name but a few, although Arc Sin and Arc Cos are absent.

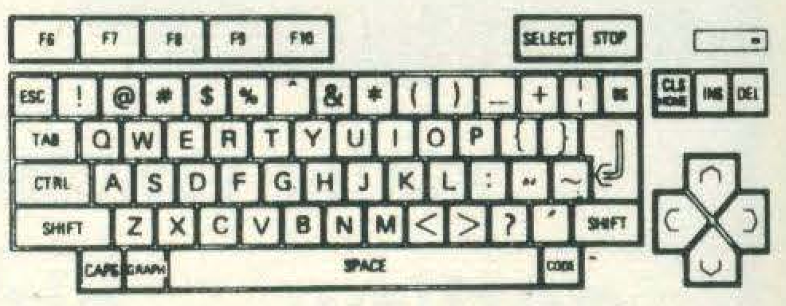
MSX BASIC allows you to create your own 'user-defined functions'. DEF FN can handle most expressions including string functions although you are still limited to single line functions.



In addition to the standard PRINT statement, MSX BASIC has the PRINT USING statement, which allows you to format the way numbers and text are displayed on the screen. This feature reminds us of the FORMAT statement in FORTRAN, but it is much easier to use, allowing you to neatly tabulate certain portions of a number. For instance, a number such as 9.17282 can be cut down to a manageable 9.17 on the screen. PRINT USING also allows you to display in exponential format, a feature which is convenient for scientific use.

An MSX micro has an internal clock which is incremented every 1/50th of a second. Using the TIME function you can program the computer to act as a clock. The internal clock can also be used to interrupt programs.

The ON INTERVAL GOSUB command defines at what time interval the GOSUB subroutine is called. You use the INTERVAL ON to switch on the interrupt and the computer will start



counting automatically while it is RUNing a program, until it is time to jump to the subroutine. The computer will continue to jump to the subroutine at the set interval, until it is told to stop by a later INTERVAL STOP/OFF statement.

There are several more commands which are similar to the ON INTERVAL command. These are event handling statements which keep a lookout for a particular event then interrupt the current program and jump to a subroutine.

The ON STRIG GOSUB and STRIG ON statement is used for detecting trigger buttons on the joysticks, and the space bar. This is particularly useful for shoot-em-up games which involve a lot of trigger pressing. It saves time since your program does not need to keep a constant look out with an 'IF STRIG=pressed THEN shoot' type of statement.

It is not only the trigger button that can be detected in this way. The function keys and the STOP key can also be made to cause an interrupt. The STOP key interrupt is particularly useful for anyone who wants to make their program break-proof. It makes the computer impossible to stop once the program is executing, which eliminates the problem of accidental exit.

This facility is also potentially dangerous because the only way out of an accidental infinite loop is by switching off the machine. The ON KEY statement can set a subroutine for individual function keys.

When two sprites collide the computer can be made to react by using the ON SPRITE GOSUB

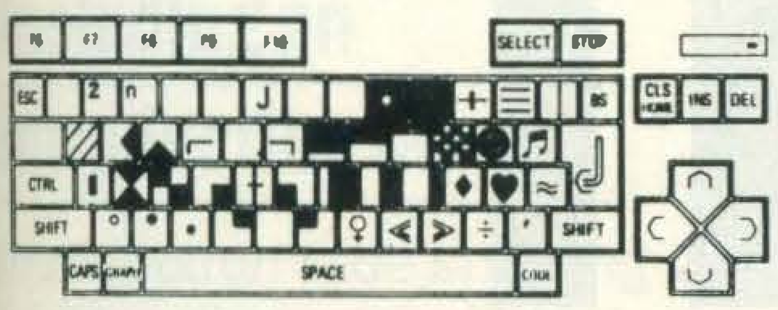
command — useful, again, for Invader type programs.

Perhaps the most useful of all the interrupt handling commands for the purist will be the error detection facility. The ON ERROR GOTO command will make the computer jump to the 'error handling routine' which you can set up to help debug your program. You can make the computer RESUME the operation without crashing out to the command level, or make it display the error and list the line which contains the fault.

Although the error messages are quite short they are understandable and it is easy to see what kind of error has been detected and at which line number. Examples of errors are 'RETURN without GOSUB' for invalid RETURN statements and 'Out of DATA' for running out of data statements. There is even an 'Internal error' for system failures, where you have to report to Microsoft what went wrong!

More advanced programmers haven't been forgotten. When Microsoft converted its existing Microsoft BASIC to MSX, it incorporated a large number of features from G W BASIC, which is an up-market BASIC for large 16-bit machines.

One of the most impressive features borrowed from G W BASIC is the provision of double precision arithmetic to 14 digit accuracy. Most 8-bit micros have less than 10 digit accuracy, but the MSX uses a special number system called Binary Coded Decimal which reduces round off errors.



Most arithmetic operations are carried out in double precision but you may choose to use single precision or even 16-bit integers for faster operation. The allowable range for double precision numbers is between 10^{-64} and 10^{63}.

To specify the type and accuracy of a variable, you use #, %, and !, while $ is for string variables. You can do away with #, %, and ! if you define at the start of the program which letter represents what type. This is carried out by DEF SNG and other statements.

MSX BASIC contains all the important logical operators such as AND, OR, NOT and XOR. There are two additional oddities, EQV (logical equivalence) and IMP (implication). These carry out standard 16-bit Boolean algebra operations.

To round up the arithmetical aspects of MSX BASIC, there are four types of number system you can use; binary, octal, hexadecimal and decimal.

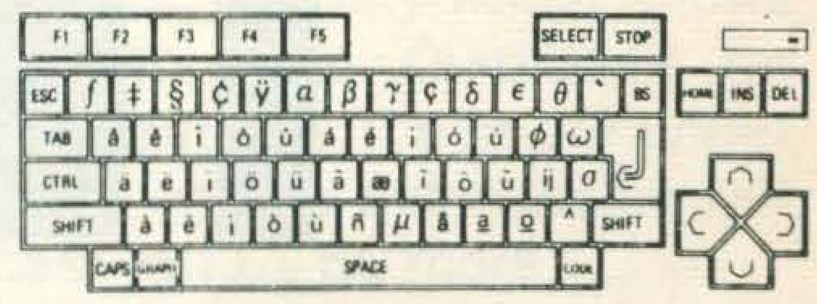
The cassette saving and loading can be as simple or complex as you like. There are three sets of SAVE/LOAD statements; one for ordinary BASIC programs, one to create ASCII files and one to store machine code programs.

There is a verify statement, CLOAD?, and a statement to merge two BASIC programs, called MERGE. It is also possible to control the cassette recorder's motor if it has a remote control socket.

Writing to the cassette as a file is quite an easy task; OPEN, CLOSE and PRINT# will take care of that. To read from cassette use the INPUT#.

From BASIC you can set which type of printer you are using and the computer will list out accordingly. To send the listing of a program to the printer, you use LLIST, a command which will not display the listing on the screen. Another printer related command is LPRINT, the printer's equivalent of the PRINT statement.

MSX BASIC can support up to two joystick ports. Commands such as STICK and STRIG deal with the status of the joysticks. However, it is not only joysticks that can be plugged into the joystick port; other devices such as games paddles (maximum of 12 units) and touch



pads (maximum of two) can be connected. These extras are also catered for in the MSX BASIC, where PDL returns the status of paddles while PAD returns those of touch pads.

If you want to access the Video Display Processor directly from BASIC then you are in luck, as the VDP function will allow you to do just that.

The RAM and the Video RAM can be accessed using PEEK, POKE, VPEEK, and VPOKE. There is a special variable call VARPTR which tells you where in memory a variable's data is stored. The BASE function will give you the current base address of the various display tables in Video RAM,

For those using machine code, the USR function will call a user defined machine code routine. This function can pass parameters from BASIC to machine code and vice versa. We should soon see a wide range of assembler/disassemblers from a variety of software houses, so serious machine code programmers will have plenty of scope.

Already in Japan there are numbers of machines with an extra ROM cartridge built-in. Yamaha has a BASIC expansion cartridge for playing music and Pioneer has a special P-BASIC to control laser discs. The whole MSX system is designed with flexibility in mind so that just about anything is possible, even for a newcomer to the world of computing.

List of MSX BASIC keywords

ABS	INKEY$	POKE
AND	INP	POS
ASC	INPUT	PRESET
ATN	INPUT$	PRINT
AUTO	INPUT#	PRINT#
BASE	INSTR	PRINT# USING
BEEP	INT	PSET
BIN$	INTERVAL	PUT SPRITE
BLOAD	KEY	READ
BSAVE	KEY LIST	REM
CALL	KEY ON/OFF	RENUM
CDBL	KEY ON/OFF/STOP	RESTORE
CHR$	LEFT$	RESUME
CINT	LEN	RETURN
CIRCLE	LET	RIGHT$
CLEAR	LINE	RND
CLOAD	LINE INPUT	RUN
CLOAD?	LINE INPUT#	SAVE
CLOSE	LIST	SCREEN
CLS	LLIST	SGN
COLOR	LOAD	SIN
CONT	LOCATE	SOUND
COS	LOG	SPACE$
CSAVE	LPOS	SPC
CSNG	LPRINT	SPRITE ON/OFF/STOP
CSRLIN	LPRINT USING	SPRITE$
DATA	MAXFILES	SQR
DEF DBL	MERGE	STEP
DEF FN	MID$	STICK
DEF INT	MOD	STOP
DEF SNG	MOTOR	STOP ON/OFF/STOP
DEF STR	NEW	STR$
DEF USR	NEXT	STRIG
DELETE	NOT	STRIG ON/OFF/STOP
DIM	OCT$	STRING$
DRAW	ON GOSUB	SWAP
ELSE	ON GOTO	TAB
END	ON ERROR GOTO	TAN
EOF	ON INTERVAL GOSUB	THEN
EQV	ON KEY GOSUB	TIME
ERASE	ON SPRITE GOSUB	TO
ERL	ON STOP GOSUB	TROFF
ERR	ON STRIG GOSUB	TRON
ERROR	OPEN	USR
EXP	OR	VAL
FIX	OUT	VARPTR
FOR	PAD	VDP
FRE	PAINT	VPEEK
GOSUB	PDL	VPOKE
GOTO	PEEK	WAIT
HEX$	PLAY	WIDTH
IF	PLAY	XOR
IMP	POINT	

SOFTWARE IN PRODUCTION



Wendie Pearson has been 'phoning around the software houses checking on the programs they'll have out for the launch

Well before the battle cry of the Japanese MSX micro invasion is heard on our shores, numerous UK software houses have been getting prepared.

Stocking up on home grown MSX software is the order of the day, with companies from Aberdeen to Southampton working madly against the clock to produce cassette, and in some cases, cartridge-based software for what they see as a profitable new market.

Reactions to the impending yellow peril have ranged from 'If you can't beat them, join them' to 'MSX is absurd, it will never work.'

A company obviously not impressed with the latter statement is **Kuma** of Pangbourne, near Reading. Numerous programs specially for MSX machines rolled off their production lines as early as August and, like the rest of their products, the prices won't make a huge hole in your already stretched pocket.

For £19.95, you can buy ZEN, an editor/assembler/debugger/disassembler to develop machine code programs on MSX micros.

'We reckon people will want to program in assembler, and this program will be useful to software houses developing programs for MSX, as well as to individuals,' said sales manager Jon Day.

Like most other software houses planning MSX software, Kuma's programs are on cassette and 25 of them have been unleashed on the public. These include adventure, arcade and graphics games, word processing, Prestel, database and home budget, all retailing between the £5.95 and £9.95 mark. Add-on peripherals are also planned.

While Kuma used Canon and Panasonic prototypes for developing their goodies, **Knights TV and Radio** of Aberdeen used Toshiba products and, from November 1, will be the sole UK distributor for Toshiba software.

Knights' first MSX titles came out in August and they now have a range of 20 costing £6 each including games, educational and home programs such as Budget Accounts.

'MSX will appeal to the family, just as a video or TV might,' said managing director Graham Knight. 'It won't hold appeal for the computer enthusiast who wants to build his own boards, etc.'

Each Toshiba micro will be sold with bundled software from Knights, including an

'Each Toshiba micro will be sold with bundled software from Knights including an introduction tape'

introduction tape showing you how to use your new purchase; Graphic Demonstration to make sure you make good use of those 16 colours. Junior Maths and Keyboard Trainer are included for those who don't know one end of a keyboard from another.

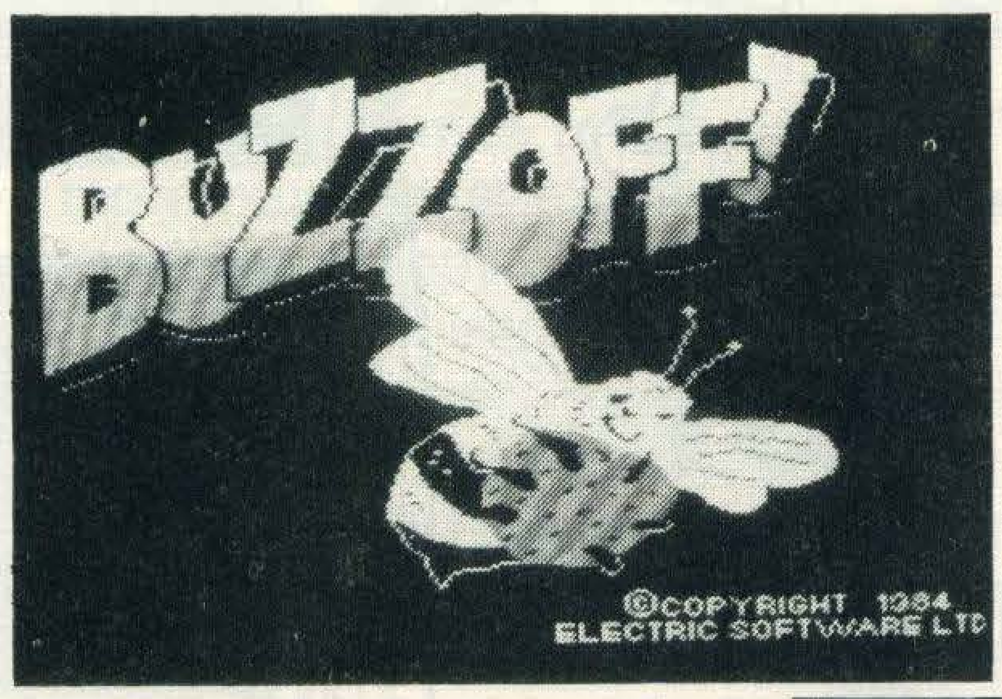
Those opting instead for a Sanyo micro will not escape Knights, either. Vicious Viper and Exploding Atoms will come tumbling out of the box along with Keyboard trainer and Sanyo Demonstrator.

PSS's software manager Campbell McCousland has three games out, plus a machine code programmers' toolkit which includes an assembler, disassembler and monitor package.

'We haven't looked at cartridges,' he said, blowing Microsoft's predictions to smithereens. 'Unless you're going to sell an extremely large number of them, it won't pay. If the price is right, the public will buy them, but currently it would be too expensive.'

His current products are £6.95 and despite the scepticism, PSS's duplicating companies have offered to put the current titles on cartridge in future if the market makes it economically viable.

Lurking in the background, meanwhile, is the MSX Working Party which consists of Microsoft, plus an array of people who are normally arch rivals. JVC, Canon, Hitachi, Mitsubishi, Sanyo, Sony, Teleton and Toshiba are also in the club. Spokeswoman Georgie Gibbs said: 'The Working Party was formed to promote the MSX standard in the UK and to do whatever it could to support that standard. It supports new developments, software houses, and even individuals who are writing books and manuals for MSX.'





These screen shots (above and right) show the sort of high quality graphics that the MSX standard makes possible in commercial software

Back on the product side, **Tasman's** Tasword II wordprocessor, previously available on the Spectrum, was released last month for £13.90, along with Tasprint, a £9.90 program which lets you produce various fonts even on the cheapest of dot matrix printers.

Games haven't been neglected either, and **Mr. Micro** have adapted five of their current range to run on MSX. These are Cubit, Puncher, Zakil Wood and Crazy Golf (which previously all ran on the Amstrad and Spectravideo) and Humphrey, which ran on the Commodore 64, Spectrum, VIC 20, Spectravideo and BBC.

Other companies with games out now include **Alligata** with Blagger and the card game, Contract Bridge, at £7.95 and £9.95, and **Electric** who launched MSX Buzz Off, Shark Hunter and The Wreck last month.

Premiere have adapted Adventure Plus, which previously ran on the Dragon 32, for £7.95 and Wordprocessor is also out at £19.95.

On the educational front, MSX has been well catered for by **MPL** of Bexhill who formed last year specifically with the intention of producing software for MSX. Their current 18 titles which are all educational will be joined by another 20 later this month.

The first batch are in sets of three for an all-in price of £14.95. There are six sets altogether, and Set 2 for 4 to 8 year olds covers basic arithmetic in the form of addition and subtraction, the use of fixed numbers and analysis.

Set 3 consists of more advanced arithmetic for 5 to 9 year-olds using formulation and analysis by shapes, number sequences and subtraction using diagrams, while Set 5 covers the application of Logic for 5 to 9 year-olds using charts, graphs and shapes.

Perhaps the most fascinating software of all is out from **Ivan Berg Software** in conjunction with **Mirrorsoft.** As early as August, they released various alternative programs such as The Josse Plan, a no-diet personal weight control system which devises an individual plan for each fatty.

Another is Know Your Own

'All in all you can expect nearly all current software to be on cassette at competitive prices'

Psi-Q which is supposed to test for psychic power using playing cards. Not to be forgotten is BBC Mastermind and Quiz Master, a utility which allows you to write Questions for Mastermind. These are under £10, while a disk version will cost you £1.50 more.

Director Mr. Ivan Berg has the most original reason for not using cartridges — he says they wouldn't hold enough information, and that a 256K cartridge would be needed before he could produce software using this media.

All in all, you can expect nearly all current software to be on cassette at competitive prices, and the situation is unlikely to change until software houses see how good the market is for MSX.

Assuming it takes off in style, most companies will consider putting software onto cartridges, which will have to be manufactured in vast quantities in order to make the price right for consumers.

The attitude of most software houses was summed up by Graham Knight. He pointed out that while the average Jap is impatient and quite likely to blow a fuse if forced to wait a couple of minutes for a tape to load, the Brits are more patient, used to cassettes, and less likely to fuss at waiting the extra time.

He and others like Jon Day see MSX as being a great success, with ready-made distribution and the backing of companies who are reliable and hardly likely to go bust. Compatibility between machines will make the system an enviable one, and only time will tell whether British manufacturers such as Acorn and Sinclair will forget their differences and get together to produce similar compatibility between their own products.

SOFTWARE COMING UP...



Wondering what software is waiting in the wings for Christmas? Wendie Pearson lifts the curtain and peeks

But what of the future, we hear you ask? Will appropriate software be in abundant supply, just as CP/M software was when CP/M was the new baby? Will MSX collapse like a deck of cards, shunned by those who believe British is best?

Apparently not, or so it would seem, judging from the number of software houses who have big plans for future MSX products. And although Acorn's founder Chris Curry has been heard to thunder that 'MSX is a doomed and out of date system', it appears his protests have fallen on many deaf ears.

The Japanese have been only too happy to use the tried and trusted Z80 processor on which to base their micros, and discs and cartridges are in the offing from various companies as well as much more cassette based software.

The market for discs looks set to take off, the Japanese having noticed just how much the English treasure this traditional form of business software. Disc drives for 3½inch, 5¼inch and 8inch discs should start arriving in their multitudes soon, in preparation for MSX-DOS, to be unleashed later in the autumn.

Disc software is already available from **Knights,** with stock control, mailing lists and accounts having been ready since August. Built for Toshiba and Sony 3½inch 360K drives, you can expand the system to network up to four disc drives.

These business programs

will sell for £60, while the drives — due to arrive next month — will be about £300.

Meanwhile, Microsoft's OEM sales manager Phil Sutcliffe spoke of his optimism regarding MSX saying: 'Although MSX will at first be pitched at the home market, the arrival of MSX-DOS means developments will head into the traditional areas of the 8-bit marketplace, ie disc based software.'

Cartridges

He added, however, that he expected the first batch of software to be on cartridge, an opinion not echoed by other companies we spoke to.

The Microsoft spokesman Jonathon Pearce also said he expected software houses to go for cartridges, since he felt they wouldn't be much more expensive than cassettes and would also be more difficult to copy, being on ROM.

'There will be much more business software, especially when MSX-DOS arrives along with Multiplan,' he said, adding that he saw the MSX market as being the same as CP/M's in the longterm.

On the buying side, Christmas looks like being well catered for. **Kuma** is releasing 25 more programs then, bringing their total number of MSX programs to 50. 'We have considered putting three of these titles on cartridge, but the problem is the cost,' said sales manager Jon Day, who figured that cartridges would cost around £20 each.

The programs concerned are likely to be geared towards small businesses; vertical market software is also being planned.

Family games

MPL has 20 more titles coming out this month for education and these will be geared towards 9 to 13 year olds. Specific applications are used, eg multiplication and mental arithmetic, with participants supposed to work against the clock.

The company plans cartridge software for the New Year provided the demand is there. Prices would hopefully be around the £10 mark, and managing director Christian Allwood says they will also do family games, 'in other words, games women will like too — those involving skill, such as Mastermind, or puzzles.'

He feels that the female market is undoubtedly geared towards 'intelligent games', as opposed to the type where you destroy the whole of creation on screen, with guns, battleships and simulated bombs.

Mr Allwood has a refreshing attitude to the matter and feels that women would rather run practical programs than the traditional blam-zap-zoom adventure-type. One can't help feeling he's right, except of course when you've had a row with your boss/husband and may need to let off steam. November should see 15 of his intelligent games at £6.95, plus five traditional arcade and adventure games to keep the more murderous members of the family happy.

'We are negotiating the rights to other titles with Japanese software houses, and would like to build up a list of educational titles which will take people to pre-University level,' said Mr Allwood, who is already planning a second range of family games.

'There'll be much more business software when MSX-DOS arrives'

Up in Dunstable, Beds, **Hisoft** are putting many of their current products onto MSX. Jens, an assembler, previously ran on the Spectrum, Sharp and Amstrad and will be available by November although the price has not yet been decided. It will come out firstly on cassette, and the company may bring it out in cartridge form too. This will be joined by a Pascal compiler.

Any farmers out there may be interested in **Farmfax**'s cash accounting system written specifically for farming. On cartridge, it costs £50 and is a full cashbook system, previously for the Dragon 32. They intend to follow this up in a few weeks with dairy, pig and arable programs, followed by more dealing with irrigation, word processing and other systems for the farm office. All these will be on cartridge, and may later be put on 5¼inch and 3½inch discs, according to Farmfax's marketing coordinator Diana Tym.

Another attachment to keep away from rampaging cows or sheepdogs with large teeth is Farmfax's Telecom Gold modem, which will come out in the spring. The current one works on the Dragon and costs £90 but Ms Tym says the MSX version may well cost less.

Melbourne House are being different and bringing out a book in mid-November entitled 'The Complete MSX Programmers' Guide' — unfortunately, details of price and author were not available as we went to press. This will join **Century Communication**'s £7.95 paperback 'MSX an Introduction'.

Toolkits

Bug-Byte meanwhile are being quite secretive and will only say that they plan releases for Christmas. They will be joined by **Premiere,** who will have utilities such as a machine code monitor, a possible toolkit and various extended machine code adventure games coming out at that time, while **CRL** will also release two games. These, Glug Glug and Omega, previously ran on the Spectrum and Commodore 64 and will cost £7.95.

For the future, Premiere plan a cartridge-based word processor for around £20 as well as disc based programs, while CRL say they are unlikely to bring out games on cartridge, but will continue to do cassette versions. They plan Fifth, a games designing program, for the New Year.

Practical programs for home use are planned by **Ivan Berg** and will include home education, self improvement, DIY and family medical history programs on cassette and disc. Cartridges will only be used if the 256K ROM comes down in price — currently, they are $25 for 100,000 making the end user price a whacking £40 to £50.

Alligata are waiting to see which way the wind blows before they put any more titles onto MSX — if it blows the right way, they will consider disc software but for the time being their only future release is Disk Warrior, out on tape (£7.95).

Games, education, word processing and utility programs are planned by **Electric** for the New Year along with disc and possibly cartridge-based software. Mick Rouss, manager, said: 'Cartridges are the thing of the future but to get them at the right price, you have to go to the Far East and we're looking into that. In the longterm, cartridges will survive as they have more advantages — they're less easy to pirate, there's more memory left in the micro to do things with if you use a cartridge.'

'Seeing the Japanese on the rampage may be a lesson to the British micro industry'

PSS will do their next batch of games in spring, leaving Christmas releases to the more traditional market. During that time, they will be working on an educational series for the Commodore 64 and may well adapt it for MSX machines.

In conclusion, one thing is for sure. People wanting British machines have suffered everything from faulty ROMs to non-delivery, with many problems being caused by bad distribution.

The latter is a problem hardly likely to afflict the Japanese with their ready-made distribution outlets, and they can certainly rest assured that their so far spotless reputations will serve them well in marketing MSX.

Seeing the Japanese on the rampage may be a lesson to the British micro industry that efficiency and high standards combined with reasonable prices pay off. Unless the already established companies take heed of Chris Curry's advice that British micro makers should work together to produce a standard interface for home machines, the public is quite likely to buy MSX instead.

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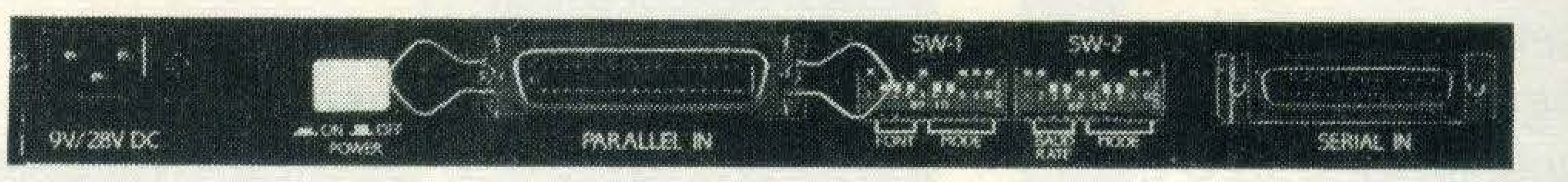
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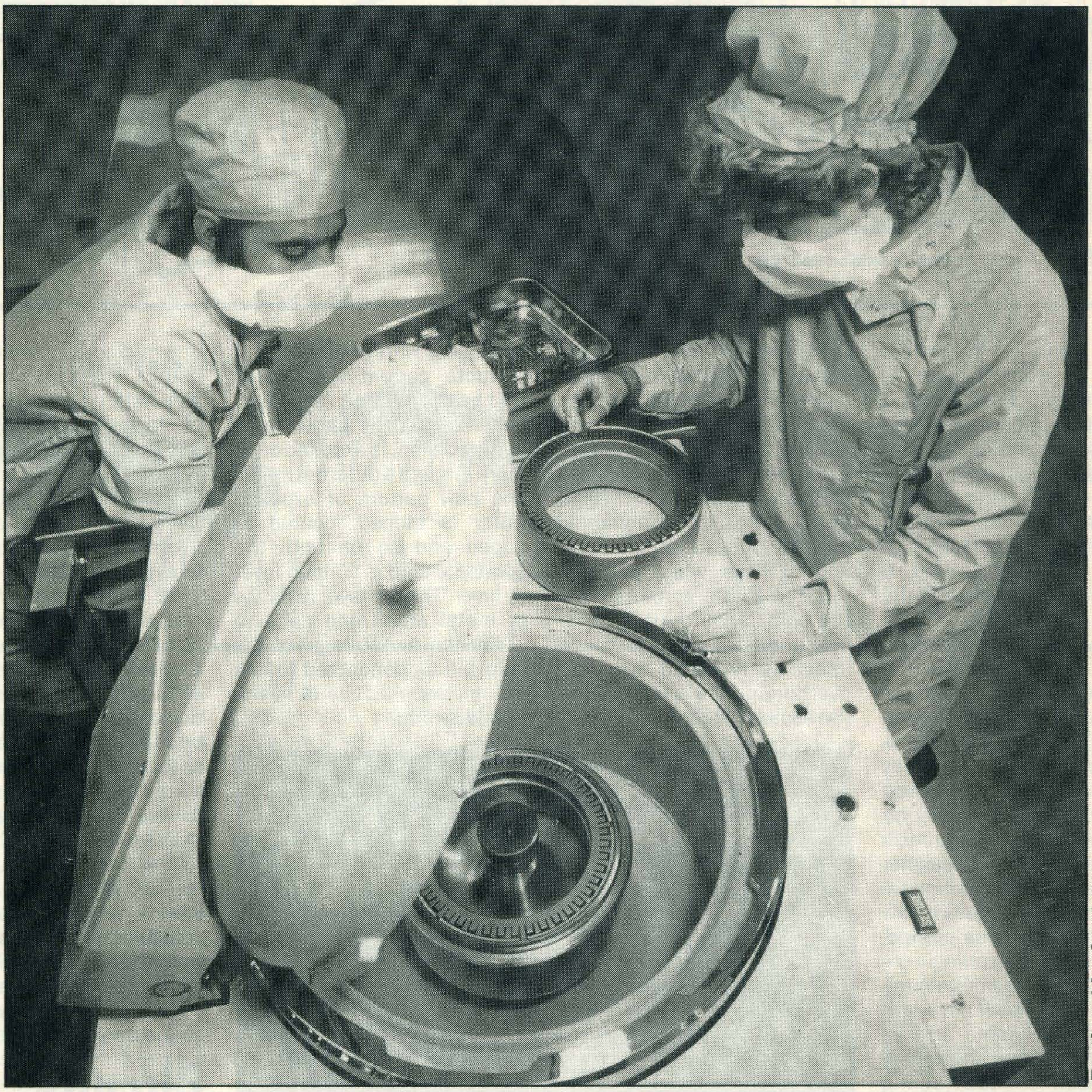
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MAKING MICROS



Testing chips for stress

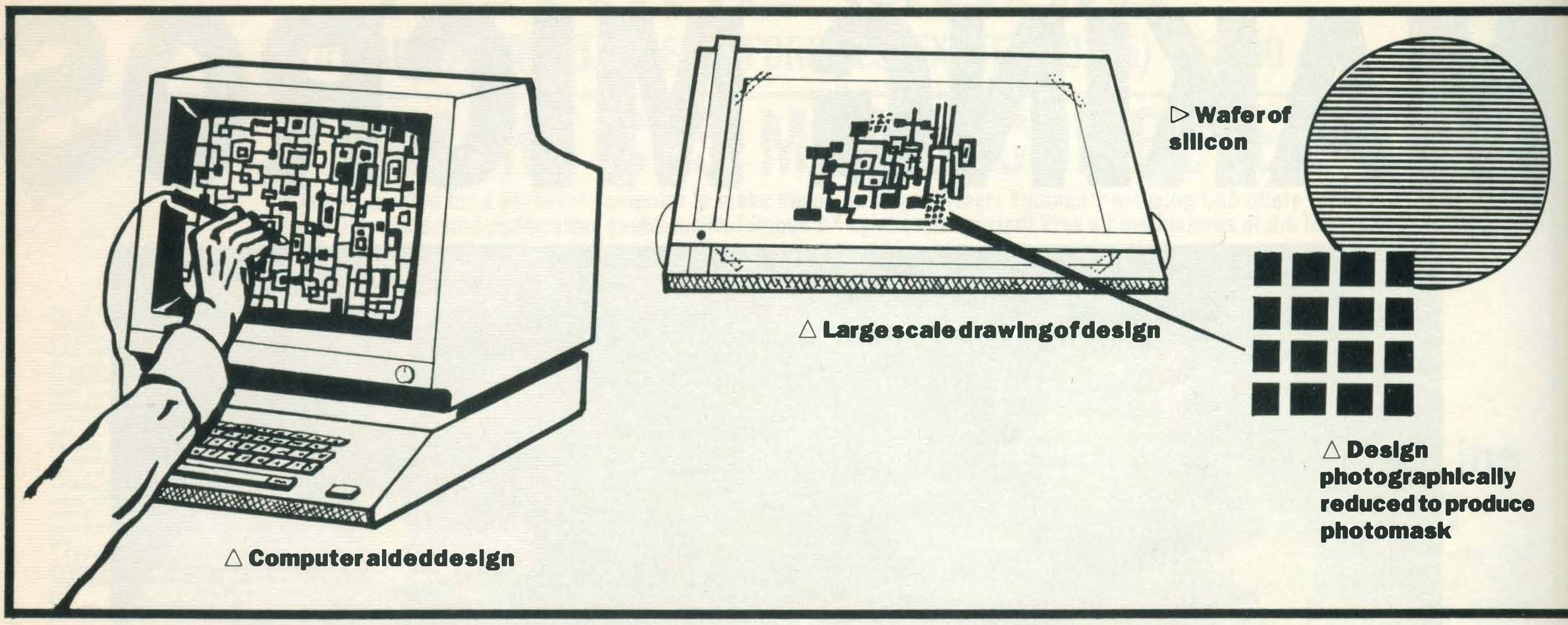
Designed by computers. Built by robots. Explained by Ian Graham

The making of a micro is a marriage between components produced by suppliers and manufacturers all over the world — chips, printed circuit boards, injection moulded cases, and electronic components — the whole jigsaw coming together at the assembly plant.

The process begins with a dull grey sausage emerging from a tank. But this is no culinary delight — it's a huge crystal grown from 99.9999999% pure silicon, the raw material from which computer circuits are made. A typical home computer might use anything from a dozen or so to perhaps a hundred of these circuits or 'chips' of different types, each carrying out a particular function, shuttling information in the form of electrical impulses around the machine. Some chips simply store information (memory chips), others perform calculations and control other parts of the computer (the central processing unit, or CPU). Fortunately for computer buyers, silicon is one of the most common elements on Earth. One form of it, silicon dioxide, is the main constituent of materials like sand.

The rough crystal is machined into a gleaming cylinder and sliced into circular 'wafers' about ten centimetres across and only half a millimetre thick. As the maintenance of purity is vital, the silicon wafers are handled in an ultra-clean environment by technicians dressed more like surgeons than electronics engineers. Swathed in masks and hoods, they must not allow any stray hair or flakes of dead skin that we all shed continually to come into contact with the silicon wafer.

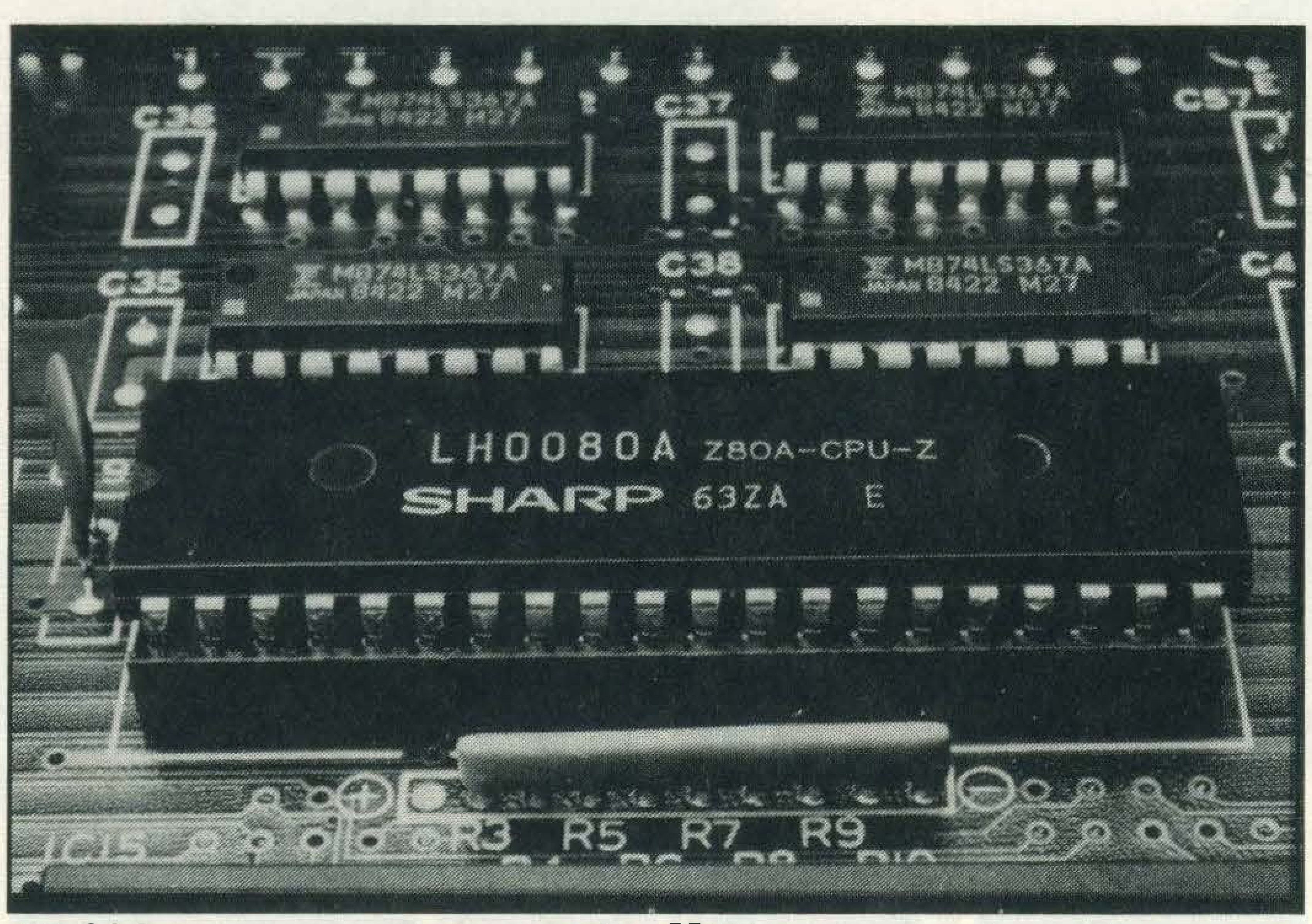
Most of the materials encountered in everyday life are either conductors (which allow an electric current to flow



through them) or insulators (barriers to electric current). Silicon is an insulator, but if traces of an impurity element like boron are introduced into the crystal, it can be made to conduct an electric current under some circumstances. The ability of this part conductor/part insulator (called a semiconductor) to shut off the flow of electric current in a precisely controlled way is central to the operation of modern digital computers.

The wafer of pure silicon forms a base on which hundreds of finger-nail sized chips are built up. But first the circuit diagram of the chip must be produced. The earliest chips were so simple that a designer could draw the circuit diagram on a piece of paper very easily and quickly. Then as production techniques rapidly developed, more and more components needed to be crammed onto the same size of silicon chip. There's a very good reason for endeavouring to squeeze a quart of electronic components into a pint-sized chip. The cost of producing a chip is largely independent of the number of devices on it. So, if a manufacturer can make one chip do the work of two by doubling the number of components on it, the cost of performing the function that the two chips previously did can be halved! That simple fact is the reason why computers are actually becoming cheaper *and* more powerful.

The circuits that will eventually become microscopic tracks on the chip are first drawn at perhaps 250 times actual size for convenience. Chips are becoming so complicated that computers themselves are commonly used to help design and draw the circuits that will power future computers. When the circuit plan is finalised, it's converted into a series of photographic images, mazes of interconnecting lines, which are then reduced to the actual size of the chip, about half a centimetre square. The reduced image is repeated over and over again on a sheet of film the same size as the wafer.



AZ-80A processor, the heart of an MSX computer. Sometimes mounted onto the PCB but seen here on a chip holder

The blank wafer is coated with a photosensitive emulsion and exposed to light through the first photographic mask. Where the mask allows light to reach the wafer the emulsion is hardened, leaving the softer, unexposed emulsion to be dissolved away chemically. The pattern of exposed areas on the wafer can be treated in a number of ways. They might be etched away, or coated with another material, or 'doped' with an impurity to promote current flow. Once that has been done, the wafer, coated again by photosensitive emulsion, is exposed once more through a different mask. The new pattern of exposed wafer is etched, coated or doped and so on until the complete chip is built up layer by layer. The top layer consists of metal strips and pads to which the metal 'legs' of the chip will be connected to link the microscopic circuit to the outside world.

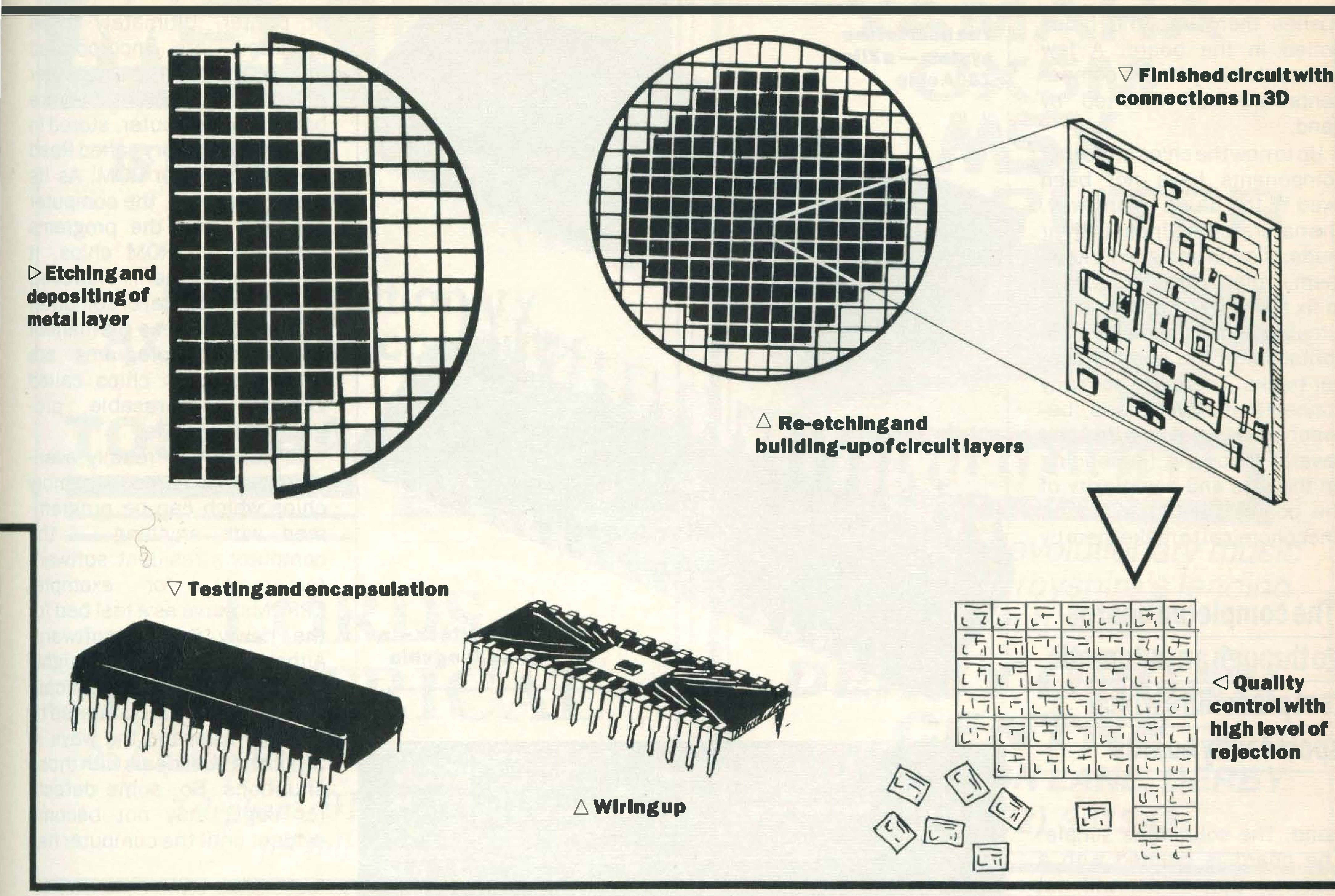
The layers of chemical tracks, bridges and junctions form components called logic gates. These will only produce an output if they are presented with the correct inputs. There are several different types, which behave differently. Some will only produce an output if all two or three of their inputs are 'live'. Others will produce an output if any one of the inputs (but not all of them) is live. The thousands of gates in a microprocessor (the computer's master control and calculating chip) allow pulses of electrical information to be fed into the chip from, say, a keyboard, and compared, added or processed in other ways, before being passed out to other devices like printers or television screens.

So, we now have a wafer containing a few hundred newly constructed chips. Before they are finally packaged they are tested to eliminate faulty devices. The wafer passes underneath a set of needle probes which are lowered onto each chip in turn to connect it to the test equipment. Any devices found to be faulty by failing the test routine are marked with a spot of dye to identify them clearly. The successful chips are separated from the wafer and move on to be packaged in the familiar black plastic block with metal connecting legs.

Circuits

Although a handful of chips and other components may contain all the circuits necessary to form a small computer, they're of no use whatsoever until they are connected to each other and to a suitable power supply. The interconnections are made not by wire, but by copper conductive tracks on a rigid laminate board. As the circuit is printed on the board, using similar techniques to those used in chip production, the board is called a printed circuit board, or PCB for short.

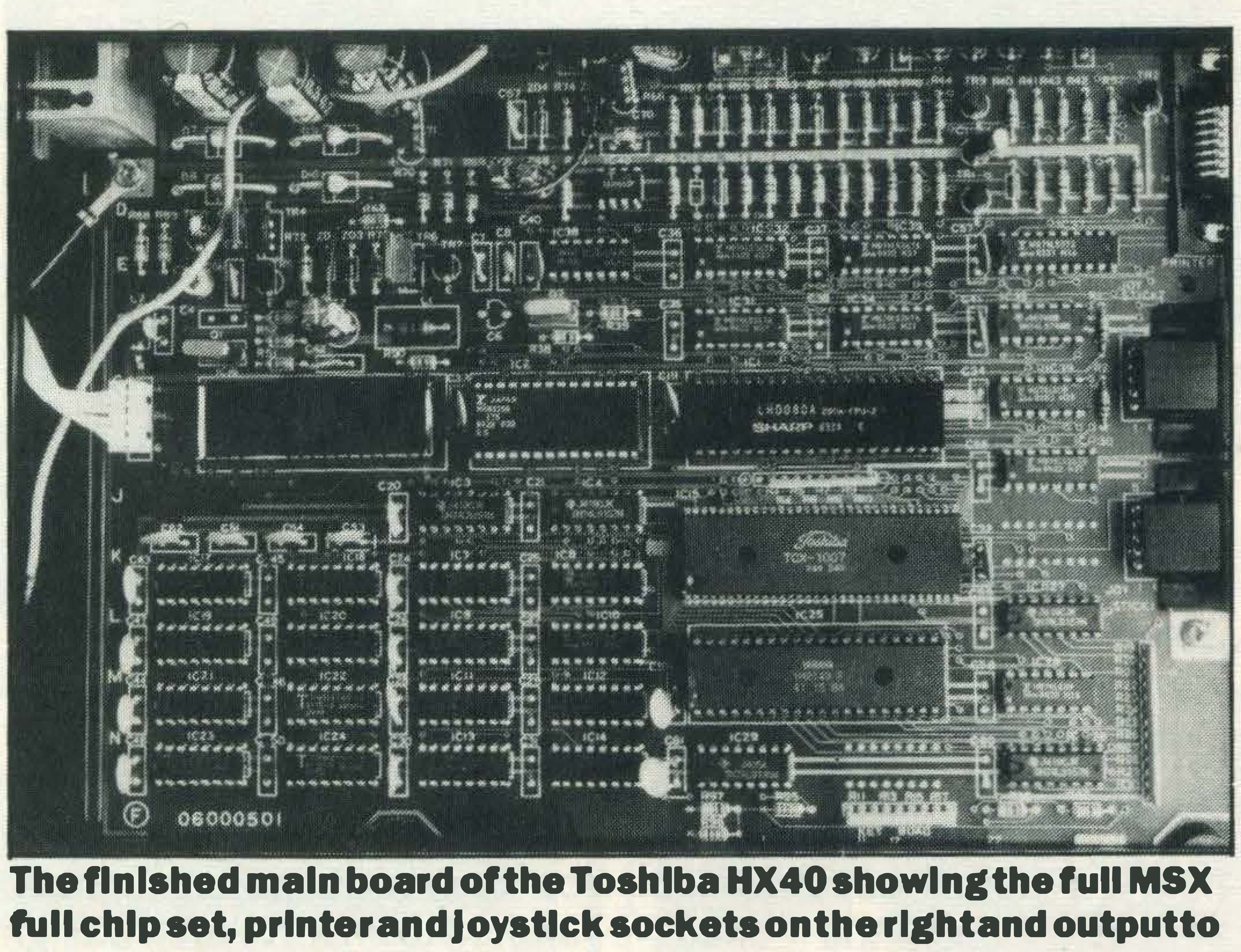
The PCB starts off as a plain laminate sheet completely co-



vered on both sides by copper foil. The circuit diagram of all the chip interconnections is drawn and turned into photographic images for the top and bottom surfaces. As there is only one layer of copper tracks on each side of the board, in contrast to the multi-layer chip, the tracks on a side cannot cross over, making the design of the chip layout on the board very tricky indeed — each chip has between 16 and 40 connections! It's now common to use computers to work out the precise positioning of each chip to allow sufficient space around it for all the interconnecting tracks. Tracks which cannot be fitted on one side because they would cross over existing tracks or there simply isn't enough room are located on the other side of the circuit board.

The board is painted with a photoresist, which protects the areas of copper that it covers. The whole thing is exposed to ultra-violet light through one of the photographic masks and the waste copper dissolved away to leave a pattern of copper conducting tracks. The positions of components are printed on the board in white to ease manual construction, checking and future maintenance. Connections between the two surfaces of the board are made by 'plating through' holes from one side to the other with metallic solder.

As you might imagine, computer manufacture is a highly automated process. The first stage of production, inserting the chips into the PCB, is carried out by a piece of equipment called an integrated circuit insertion machine. An 'integrated circuit' is just another name for a chip. The job of the machine is to insert the correct chips into the correct positions on the PCB. A typical insertion machine is capable of inserting up to 60 different types of chip into a board and can handle boards of different sizes, from a tiny computerised game to a much larger circuit board for a business computer.



The finished main board of the Toshiba HX40 showing the full MSX full chip set, printer and joystick sockets on the right and output to PAL modulator on left

Obviously, the insertion equipment must be controlled. It must have some way of 'knowing' where to position which chips on the board. You guessed it — this computer manufacturing machine is itself controlled by a computer. The positions and types of chips to be inserted are stored in a computer program. So, to switch to a different circuit board, the machine need only be given a new program and a fresh supply of the correct types of chips.

Components

Now we come to all the other small components that make up the computer — resistors, capacitors, etc. Like the chips, the differnt components must be inserted into the correct positions on the board in the correct order. Supplies of the various components are fed into a machine called a sequencer, which automatically tests them, puts them in the correct order for insertion and mounts them on continuous strips of paper called a bandolier for more convenient handling. The bandoliers then feed the components into another insertion machine which

pushes them into the holes drilled in the board. A few awkward or very fragile components are still inserted by hand.

Up to now the chips and other components have not been fixed to the board in any way. The natural springiness of their leads, friction and gravity keep them in place. The next task is to fix them permanently to the circuit board in good electrical contact with the board's copper tracks. There are so many connections to be made, between a couple of hundred and several thousand (depending on the size and complexity of the board), that it would be uneconomical to make them by

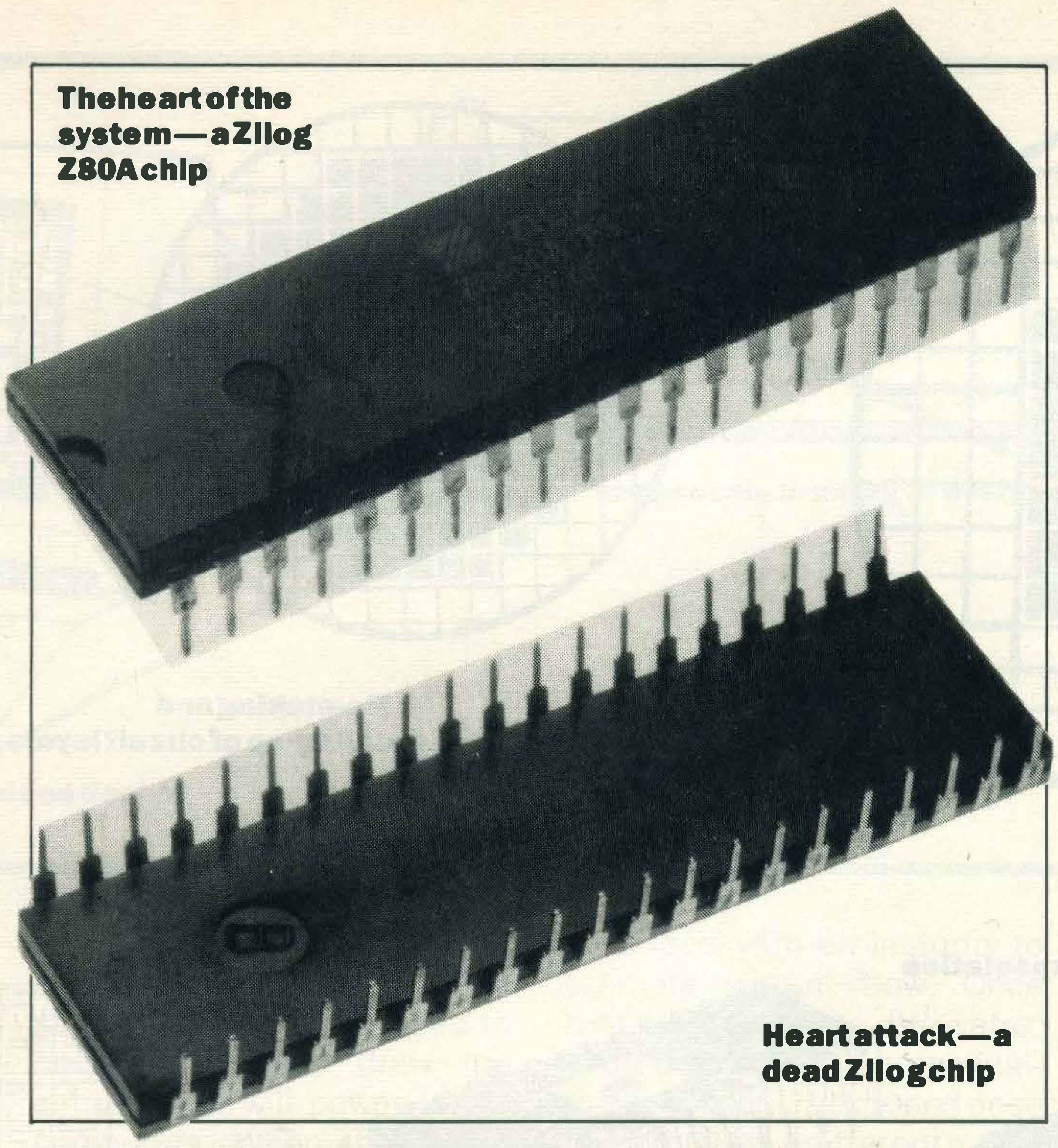
'The completed boards go through an automatic test procedure which spots faulty boards'

hand. The solution is simple. The board is painted with a material that solder will not stick to. Solder is a mixture of lead and tin that melts at a relatively low temperature and so it can be used as a sort of electrically conductive glue to connect all the components together. The places where component leads are to be linked to the board are left unpainted.

In a process called flow soldering, the board is passed across the surface of a bath of molten solder, which only runs onto and sticks to the unpainted areas. In practice, the solder needs some assistance to 'wet' the board and component leads, so the metal surfaces to be soldered are first coated with a 'flux' that the solder will run onto very easily.

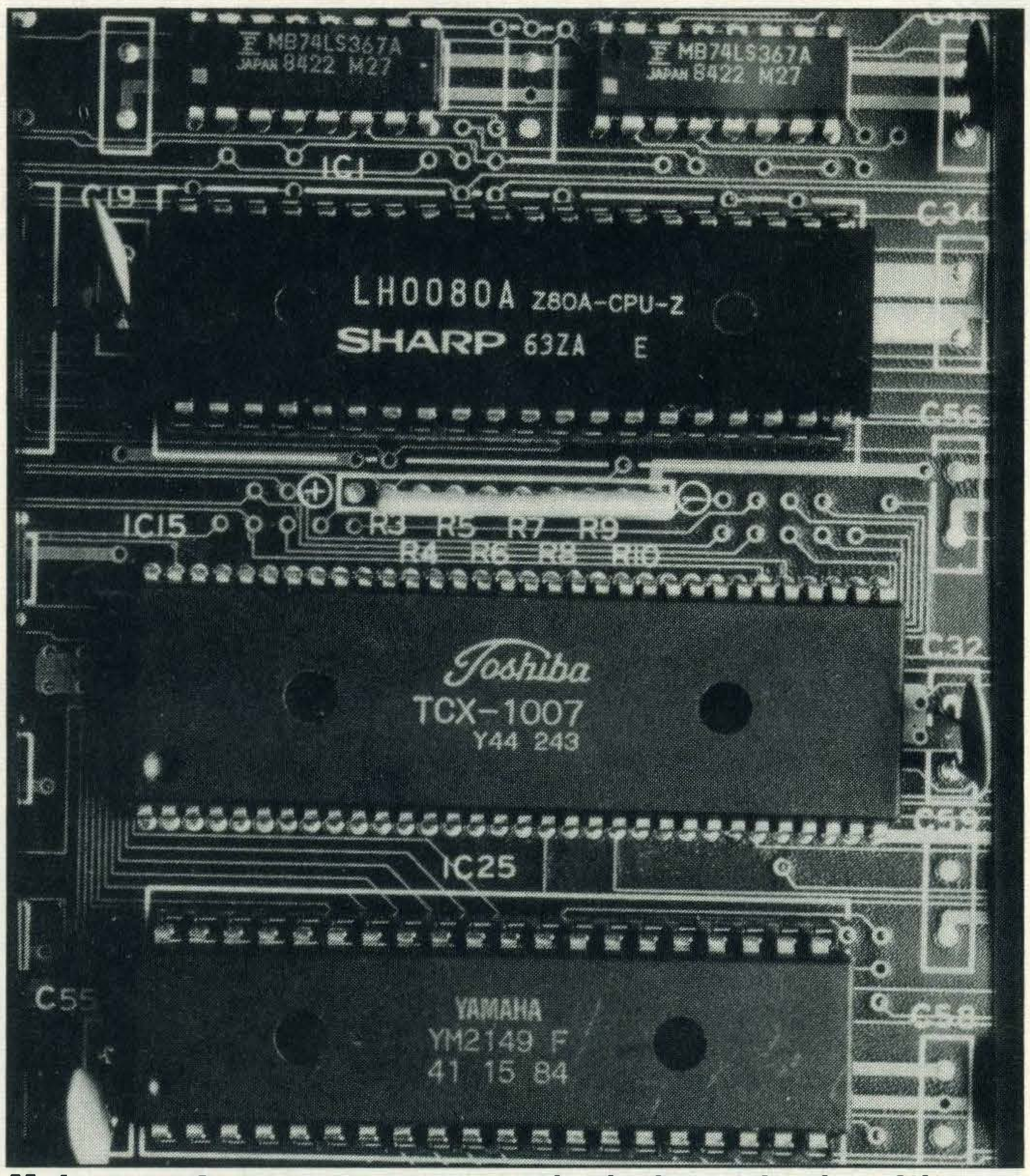
Delicate components that might be damaged by the heat of the solder bath are inserted by hand at a later stage. The completed boards go through an automatic test procedure, which not only spots any faulty boards, but also identifies the fault. Any boards found are taken out for individual inspection and repair.

While all this has been going on, the keyboard unit (basically a grid of switches) will have been contructed on a parallel assembly line in the same



The heart of the system—a Zilog Z80A chip

Heart attack—a dead Zilog chip



Major manufacturers are co-operating in the production of the integrated circuits that go to form the MSX chip 'set'

plant, or may arrive from an entirely different supplier. The plastic casing, also probably from a different supplier, the keyboard and the circuit board(s) are assembled and put through a final series of tests to ensure that the whole system is performing as it should. Finally, it's packaged with the necessary documentation and leads and dispatched to computer retailers in several countries.

That isn't the end of the story. Home computers are continually being updated and altered to improve their design and iron out any problems that become evident. Some programs are permanently built into a computer. They control, among other things, how information passes between the computer and 'peripheral equipment' like a tape recorder or printer. Ultimately these programs are incorporated into some of the computer chips at manufacture. They are part of the computer, stored in part of its memory called Read Only Memory, or ROM. As its name suggests, the computer can only read the programs contained in ROM chips. It cannot alter them. However, when a new model of computer is released, these permanent or 'resident' programs are often stored in chips called EPROMs — erasable, programmable ROMs.

EPROM'S are readily available general purpose memory chips which can be programmed with anything — the computer's resident software (programs), for example. EPROMs serve as a test bed for the newly written software. Although it is thoroughly tested, tests rarely duplicate every situation encountered by the real user and the ways in which the user deals with those situations. So, some defects (or bugs) may not become evident until the computer has

'Any bugs which come to light can be solved and the software rewritten and tested'

been in general circulation for a while. Any bugs which do come to light can be solved and the software rewritten and tested by reprogramming the relevant EPROM(s).

When the first issue of the computer has been thoroughly tested to the manufacturer's satisfaction, the EPROMs can safely be replaced with ROM chips manufactured with the necessary software permanently built into them. Moreover, if there are any delays in the initial supply of ROM chips, EPROMs can be used as a stop-gap measure.

This then is the process which brings components together from many suppliers to a central assembly plant with almost military precision to feed the sequencers and automatic insertion machines, which turn them into a working computer. ■

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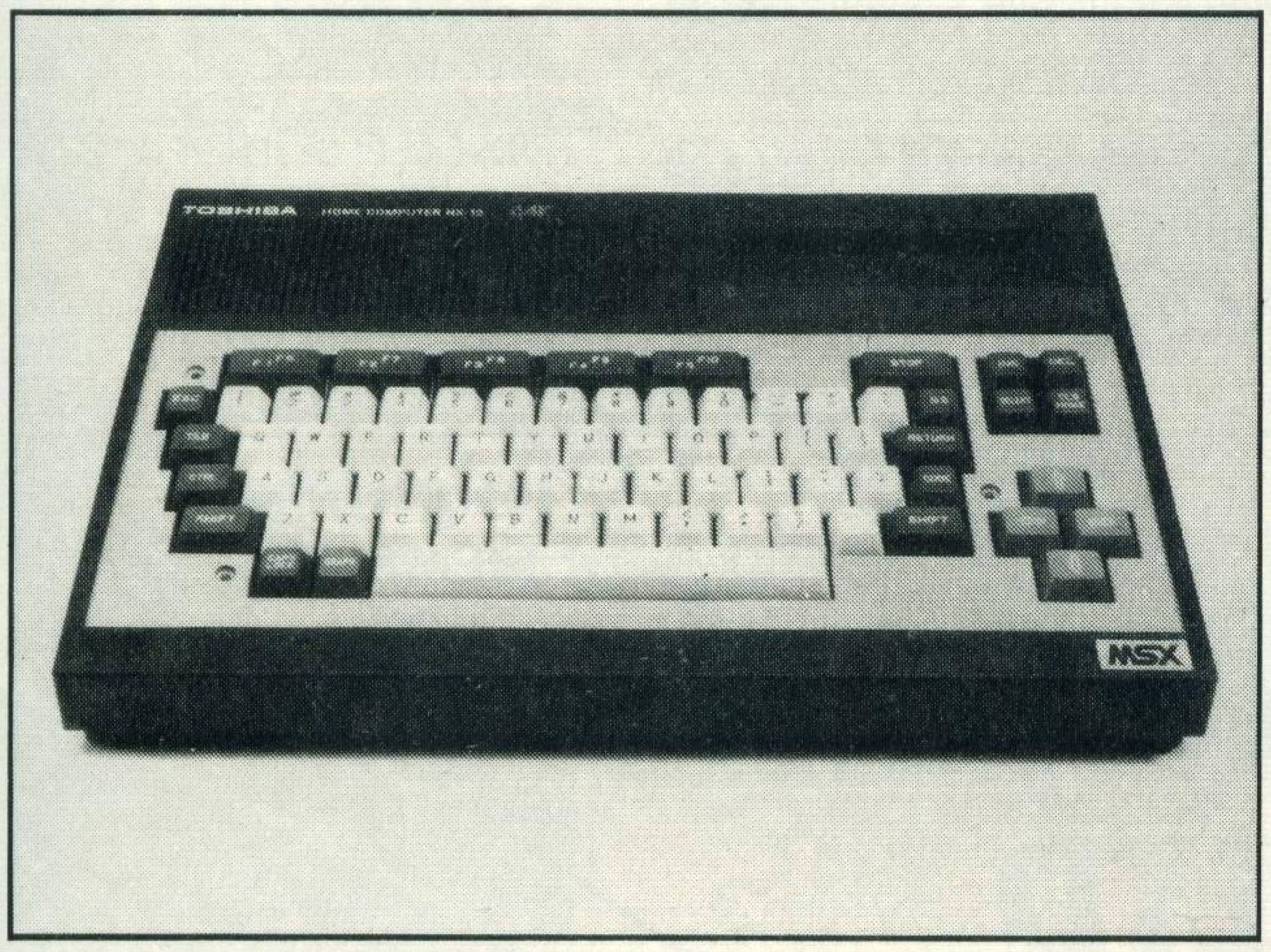
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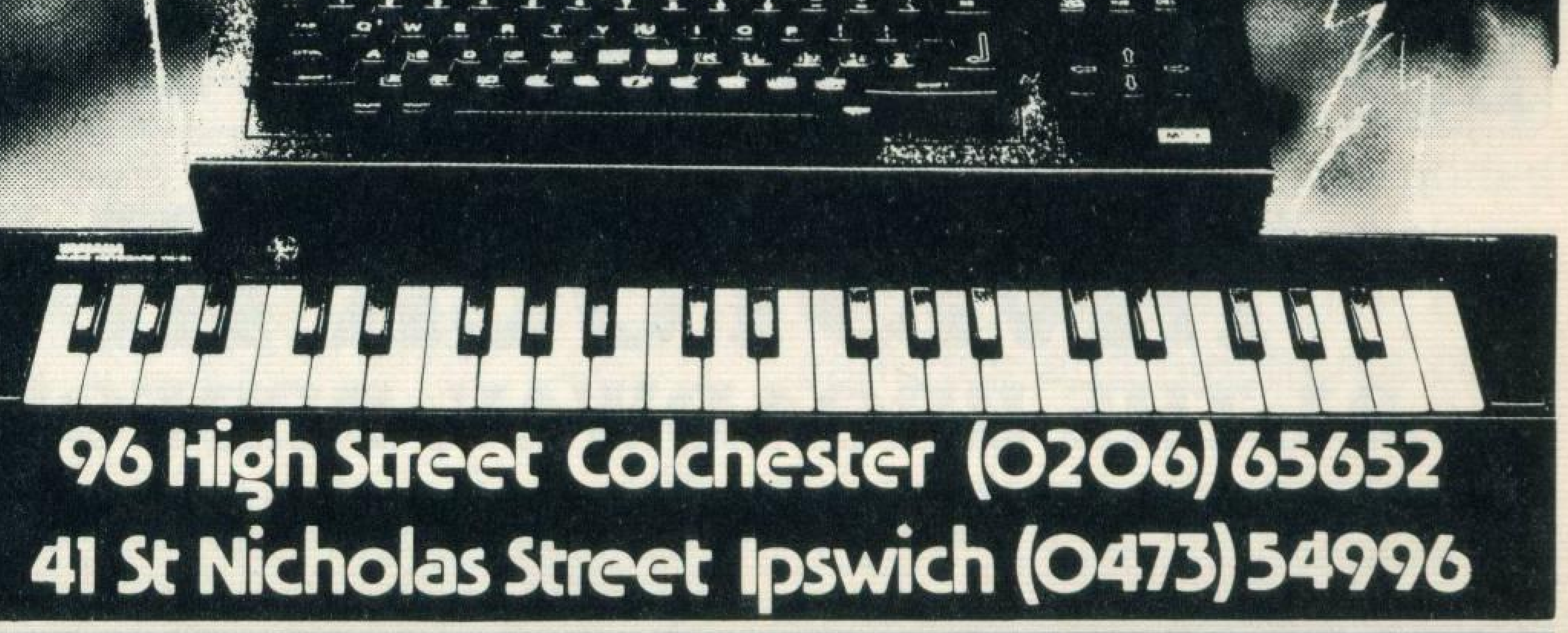
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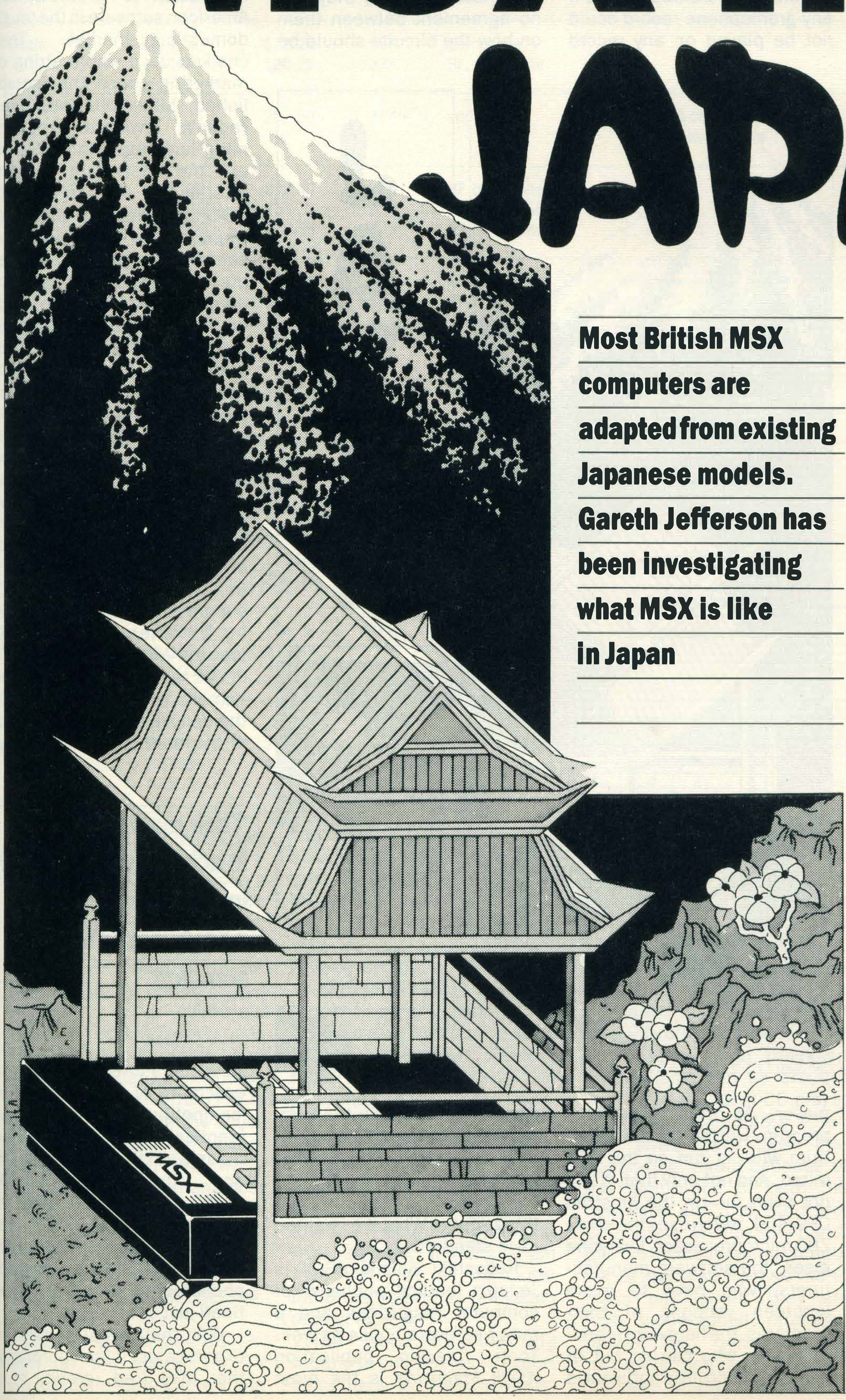
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MSX IN JAPAN



Most British MSX computers are adapted from existing Japanese models. Gareth Jefferson has been investigating what MSX is like in Japan

People in the computer industry have been saying, for the last two or three years at least, that the Japanese computer will be arriving on these shores in force any time now — and when they do, British computer industry look out!

But it didn't happen. True, NEC sold a few of their PC-8000 series machines, Sharp have made a reasonable penetration with their economical MZ computers and a handful of the other big names are there lurking in the background. But compared with the familiar British names (Sinclair, Acorn, Oric, Dragon and so on) the Japanese are hardly even also-rans — until now. The MSX computers now starting to come in from Japan represent a concerted effort by the masters of industrial cooperation to change the face of British computing. The thinking behind the MSX standard is simple enough, but first some background on the martial arts of industrial domination.

After the devastation of the last war, when Japan took stock of its situation, it realised that a population double that of the United Kingdom with very little usable land and virtually no natural resources was hardly a recipe for success. So Japan decided to invest in high value-added goods; first steel, then ships, then motorbikes and cars, cameras and electronic components. In the process it learnt some valuable lessons about industrial cooperation

and standardisation.

Experience has proven over and over again that the standardisation of products is the way to gain wide acceptance, and nowhere is this more true than in the area of high technology. One reason every household in the land has a record player is that any player will play any record — 'Sorry, I can't buy that record 'cause I've got a JVC record player and that's a Yamaha disc!' is something, thankfully, you won't hear. But Europe and America has not always been so receptive to the idea of standards. Facsimile machines, for example, were a European invention, but it was the Japanese who got together and produced the GII and GIII standards, so that my Toshiba FAX can talk to your Panasonic FAX. Needless to say, the Japanese now dominate the FAX market. They tried with video recorders, they're doing the same with audio Compact Discs and laser video discs.

We tend to think of Japan as a country of immitators rather than innovators, and to some

'In the computer field the Japanese, like the rest of the world, have had to follow the Americans'

extent this is true. In the computer field the Japanese, like the rest of the world, have had to follow the Americans. Consequently, the few standards there are have been American standards; and it's amazing how few standards there really are. The IBM single sided, single density eightinch disk is one. Other hardware standards and quasi-standards include the Centronics parallel printer port and the RS-232C serial port (a 'standard' honoured more in the breach). Software has fared little better, though the CP/M operating system has been hugely successful (more from want of any better standard than from intrinsic merit), Microsoft's MS-DOS is now the *de-facto* standard for 8088 and 8086 based 16-bit computers, and Microsoft's BASIC-80 is as near as BASIC has ever managed to get to a standard.

What all this lack of standardisation means to both the hardware and the software manufacturer can be likened to the situation we would have if any gramophone record could not be played on any record player. As things stand, a program written for the Spectrum will not run on the BBC micro. And not only that, it will not even run on the Amstrad CPC-464, which uses the same Z80 microprocessor. Everyone loses, the software manufacturers, who have to make umpteen versions of their programs, the hardware manufacturers, who can go out of business if too little software is produced for their machines, and the buying public, which is at the end of the chain along which all the increased costs are passed.

The early microcomputers were made mainly by garage and attic outfits run by the young, enthusiastic computer hobbyists. Naturally they had no agreement between them on how the circuits should be configured and how the software should work. Such anarchy was all very well for a while, but not the way the mega-corporations of Japan like things done. What they wanted were standards.



Kabushiki Kaisha ASCII is Japan's leading publisher of computer magazines and a major software house as well. Their flagship publication *ASCII Magazine* is the most prestigious and biggest selling computer periodical in the country. The company's substantial connections with every section of the Japanese computer industry made it a natural partner for America's Microsoft Corporation, and the two firms set up a joint venture, ASCII-Microsoft, to promote the American software in the tough domestic market. They chalked up a whole string of marketing coups that established Microsoft BASIC as Japan's favourite programming language, and MS-DOS as the operating system offered by all the leading 16-bit makers. But their real triumph was to achieve the seemingly impossible, to create a hardware/software standard for 8-bit micros in cooperation with virtually all the big Japanese names. The technical details of this standard are covered elsewhere in this magazine and need not be considered here. The important thing is that giants such as Sony, National, Hitachi and even mainframe maker Fujitsu are all selling MSX computers that are cheap enough for anyone to buy. At the last count (mid-July 1984) there were 12 separate Japanese firms making 26 different MSX models (see the 'MSX Who's Who' box). Prices range from £155 for the Yamaha ¥IS303 up to £460 for the de luxe Paxon from General; the mode is ¥64,800, about

'Their real triumph was to achieve the seemingly impossible, to create a hardware/software standard'

£200. It is interesting to note how many of the models from 'competing' companies have identical prices. There are five models at ¥54,800 (£171.25) and five at ¥64,800 (£202.50). Although there are anti-trust laws in Japan, and price fixing is supposed to be illegal, this is a very common phenomenon and is not confined just to computers.

With their eyes on massive export sales, it isn't surprising that RGB (red, green, blue)



'Computers use intrinsically cheap components and lend themselves to mass production'

Company	Model	Price	RAM	Video Output	Notes
Canon	V-10	171.25	16K	RF, composite	
	V-20	202.50	64K	RF, composite	
Fujitsu	FM-X	155.63	16K	RF, RGB	Uses TMS-9928A VDP, no printer port
General	Paxon	457.81	16KB	RGB	Integral monitor
Hitachi	MB-H1E	171.25	16K	Composite	
	MB-H1	196.25	32K	RF, composite	
JVC	HC-6	202.50	32K	composite	Uses TMS-9928A VDP Superimpose adaptor
Mitsubishi	ML-F120	202.50	32K	RF, composite	
	ML-F120D	233.75	32K	RF, 21 pin RGB	
	ML-8000	186.88	32K	RF, composite	
National	CF-2000	171.25	16K	Composite	No printer port
	CF-3000	311.88	16K	RF, RGB	
Pioneer	PX-7	280.63	32K	RF, comp., RGB	Audio mixing, superimpose, extd. BASIC
	PX-V7	306.25	32K	RF, comp., RGB	Same as PX-7 but has built-in video-disc player interface
Sanyo	MPC-5	171.25	16K	RF, composite	No printer port
	MPC-10	233.75	32K	RF, composite	Includes light pen
	MPC-11	311.88	32K	21 pin RGB	Superimpose function
Sony	HB-55	171.25	16K	RF, composite	
	HB-75	218.13	64K	RF, composite	
Toshiba	HX-10SA	174.38	16K	RF, composite	No printer port
	HX-10DP	211.88	64K	RF, composite	
	HX-10DPN	218.13	64K	21 pin RGB	
Yamaha	CX-5	186.88	32K	composite	All Yamaha models use TMS-9928A video chip (except YIS303)
	CX-5F	202.50	32K	composite	
	YIS303	155.63	16K	composite	
	YIS503	202.50	32K	composite	

video outputs are almost as common as RF (radio frequency) or composite. Japan's domestic colour television standard is the NTSC (National Television System Committee), virtually identical to the one used in the United States and certain other countries. Much of Western Europe uses the PAL (Phase Alternate Line) colour standard, including Great Britain (though our PAL is not quite the same as European PAL). Australia, New Zealand use 'English' PAL, while France, the Soviet Union, most of the Eastern block and much of the Middle East uses the SECAM standard, but again, French SECAM is not the same as Middle Eastern SECAM. Confused?

The reason for this digression on the subject of TV standards is simply to explain why RGB video outputs are so common on Japanese MSX computers. An RF or composite TV signal designed to work with an NTSC television will not work if plugged into a PAL or a SECAM set, but an RGB signal should work with any RGB monitor, in any country, as chrominance (colour) encoding is not involved. Another factor is that 'component TV' is becoming increasingly popular as manufacturers try to give a new lease of life to flagging domestic colour TV sales. These sets generally have direct composite video inputs and many also accept analog RGB signals, making them ideal for use as computer monitors as well as television receivers.

The need for the big Japanese companies to export computers is fairly obvious. Many of them used to (and still do) dominate the audio equipment market, but this has reached saturation point in Japan and is much less buoyant overseas than it was. The new lease of life they are hoping for from Compact Disc has failed to materialise, and probably will not do so until the cost of the high precision mechanisms can be brought down (the cheapest CD player is currently about £280). Video disc sales have been disappointing, again because of the high price of both the hardware and the software. Computers, on the other hand, use intrinsically cheap components and lend themselves to mass production. They are high value-added products, unlike, say, cars or video recorders, and require little in the way of raw materials or energy input. The only thing wrong with this scenario was the lack of standardisation, and MSX seems certain to change all that. I think we can now look forward to a computerised action replay of what happened in the fields of 35mm cameras and consumer audio; the Japanese manufacturers will put their combined weight behind the products, with aggressive promotion and fierce price competition. British consumers are sure to gain. British manufacturers may soon find themselves with their backs up against the wall.

Add ons

Things do not stand still for long in Japan, and the MSX market is no exception; all kinds of new MSX machines, add-ons and software are appearing. Ever thought how difficult word processing could be in a language like Japanese, that uses thousands of Chinese characters (called Kanji) as well as two kinds of phonetic script (called hiragana and katakana) as well as the western alphabet? Large Japanese language word processors are commonplace in businesses, but the home computer user has tended to be neglected — not surprising when you think

FEATURE



Japanese keyboards have Kanji characters marked on the keys



about the difficulties of entering, displaying and printing characters that can be made up of as many as 20 separate strokes or more. But help is at hand for MSX owners. Yamaha has announced a ROM cartridge that plugs directly into their computers or into other MSX machines using a simple adaptor. The Yamaha Kanji ROM and word processor sells for the equivalent of a very reasonable £155.

Pioneer are keeping a high profile with some exciting hardware and rather unusual software. Their PX-V7 is one of the latest MSX machines; it appeared in late May. It has a built-in interface to connect directly to the Pioneer V500 laser disc player, making video disc control by computer an affordable luxury. Sony are also supporting this concept, but so far only with their up-market SMC-70 (non-MSX) computer. Computer controlled video discs have great potential as educational aids, but their games potential has not been overlooked either. The first home computer simulation game on video disc — a war game set in the Japan Sea — has been announced by Pioneer specially for use with MSX computers, presumably with their PX-V7 in mind. Pioneer's extension to MSX-BASIC called P-BASIC includes commands such as WIPE to allow fading between video input to the monitor and computer generated overlays on the monitor screen.

JVC, known in Japan as Nihon Victor, owns the famous His Master's Voice logo (not Toshiba/EMI as you might suppose) and is also an avid supporter of the 'audio visual personal computer' concept. Their HC-6 also allows rather nice superimposition of computer generated graphics onto television pictures taken off air or from video discs. Similar capabilities are built into the MPC-11 from Sanyo.

Educational and games software in the MSX format is now too numerous to catalogue, and just to add to it, Toshiba/EMI (the record company joint venture) has announced 60 new games titles on cassette, to be marketed under the Toemiland brand name. Yamaha are very active too. Apart from the Kanji word processor mentioned above (which incidentally, has an optional 16 × 16 dot matrix printer for Kanji printing at £280) they give lots of support for silicon composers. There are 44 and 49-key keyboards that plug into the back of the YIS503 computer and several popular pieces of music making software, all on cassette at around £24 a time.

'Educational and games software for the MSX system is now too numerous to catalogue'

Some surprising facts emerge when you look at who is buying MSX computers in Japan. The percentages vary slightly from one brand to another, but the general trend is clear, so let's look at the figures for just one product, the Matsushita (National) CF-2000. It sells for ¥54,800 (£170) so, although not the cheapest, it is one of the least expensive. Over 50 per cent of the people who have bought it are teenies and weenies 19 years old or below. 14 per cent of purchasers are between 20 and 29. 17 per cent are between 30 and 39, about 10 per cent are between 40 and 49 and just over 5 per cent are aged over 50. The remaining few per cent didn't fill in their cards right.

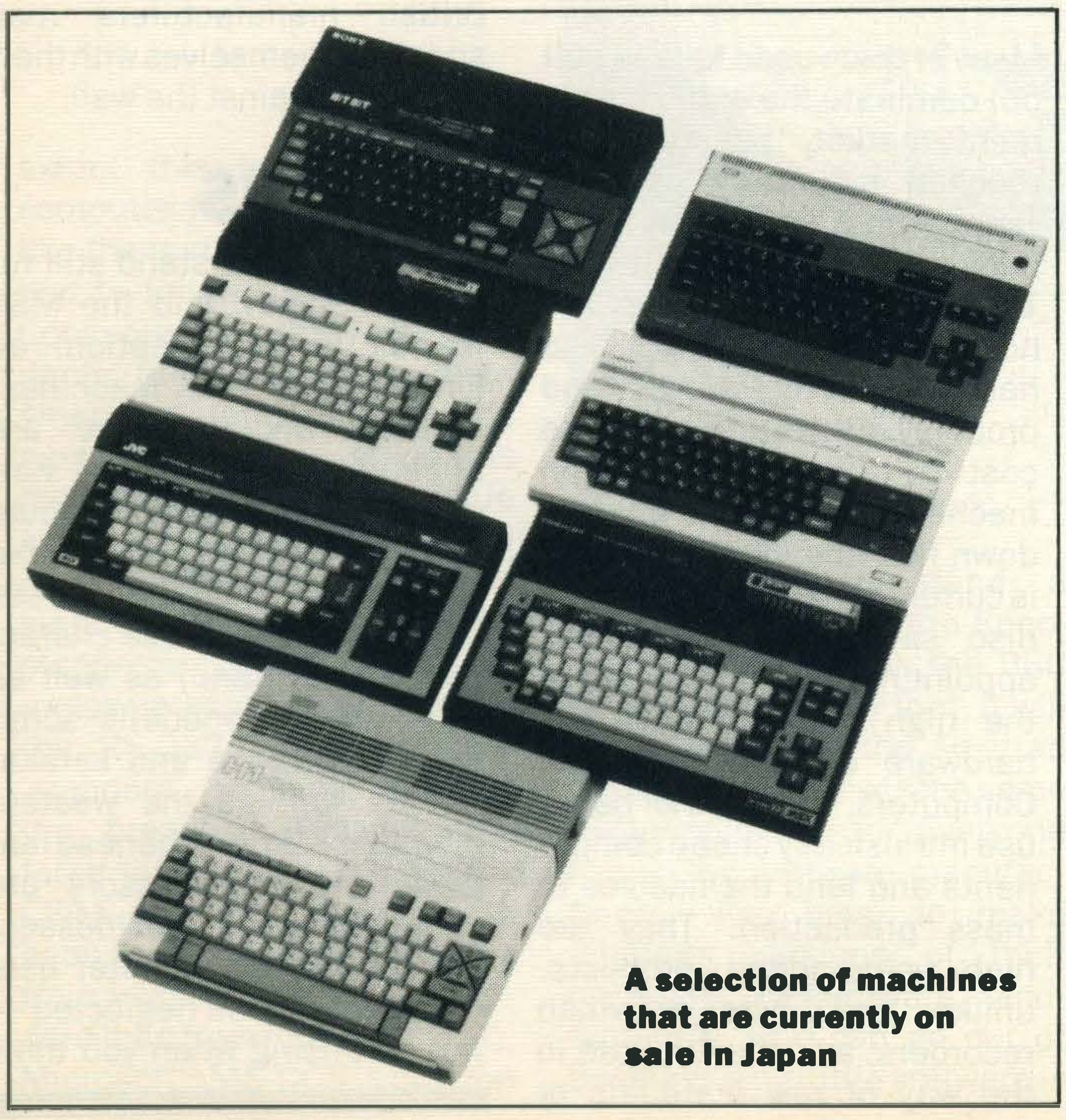
And what are all these people doing with their MSXs? Looking at the breakdown for the same CF-2000, we find that 43 per cent bought them to learn about computers, 35 per cent admit to having bought them for playing games and the remaining 22 per cent bought them for 'serious' applications such as business, word processing and music composing.

Will the same trends be maintained in the United Kingdom? Or, as seems more likely, will MSX computers be bought by a slightly older and more knowledgeable public? Time will tell.

All the usual options are to be had, from joysticks, through high speed data recorders to lightpens, micro floppy disk drives and speech synthesisers. In a word, there's something for everybody. Even the businessman is catered for. Canon took the opportunity of this year's Japan Business Show to launch the easy to use Multiplan business software for MSX machines using 3.5 inch floppies.

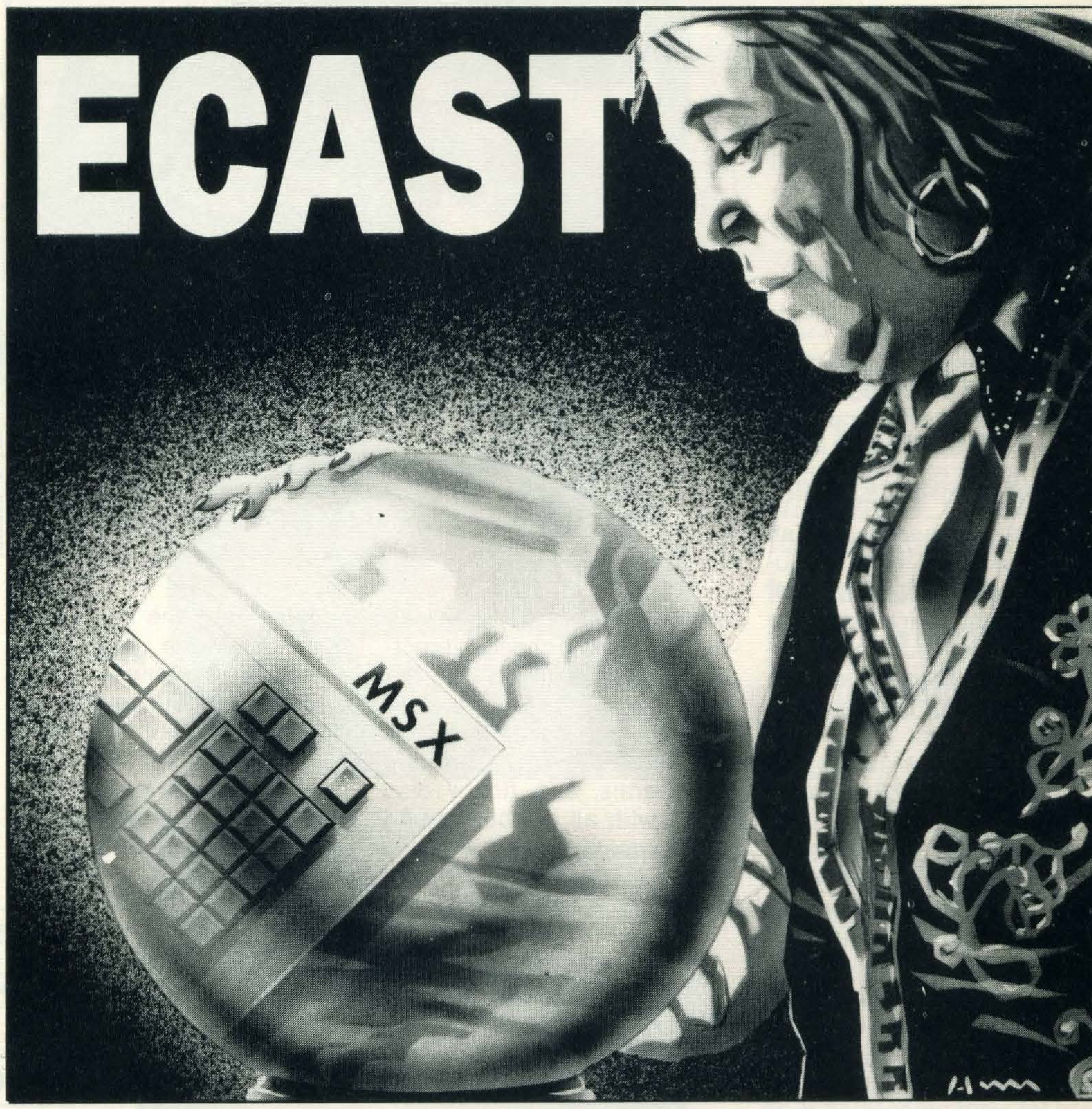
MSX computers first saw the light of day just about a year ago in Japan and have made a significant, if not as dramatic an impact as some had expected. The MSX share of the personal computer market — and that includes small business machines such as NEC's PC-8000 series — is just over 15 percent in terms of number of units sold. Among MSX makers themselves, the biggest share is held by four companies, Sony, Matsushita (National), Toshiba and Fujitsu. Between them they account for about 20 percent of MSX sales and are producing about 10,000 units each a month.

Next in the league table come Canon, Nippon Gakki (Yamaha), Hitachi, Sanyo and Mitsubishi. They get a slice of the cake of between 5 and 10 per cent and each produce about 5,000 MSX computers monthly. Next come Nihon Victor (JVC), General and Pioneer. The rest? — also rans. ■



A selection of machines that are currently on sale in Japan

MSX FUTURE FORECAST



Many ideas have been mooted for the future of MSX. Richard Dean looks ahead to what might be around the corner

Talk to MSX manufacturers about the future and they will wax lyrical on the goodies around the corner. But check that with the Sinclairs or the Commodores of this world and you'll get a completely different response.

'Too little, too late', 'Suffers all the restrictions of a fixed system', 'Just a gimmick from Japan Incorporated' are among the more polite answers you might expect from the established home computer majors.

Clearly a little more scrutiny of the MSX supporters' claims is needed. While companies not making a range of equipment designed around a new operating system and standardised features can be expected to apply liberal quantities of cold water on the idea, what do MSX firms mean specifically when they talk about the future expansion of their system?

One of the first points they stress is what all MSX people rattle on about — standardisation. We all know this will allow software and peripherals to be freely exchanged between brands. It also allows the free flow of the computer world's ultimate lifeblood, money. More specifically, a technology that won't suddenly change or disappear tomorrow tends to attract a more sustained programme of investment. Any readers doubting the longevity of MSX should remember that this relationship also works the other way round.

Will the first crop of MSX machines be 'Too little, too late' in Commdore's immortal words? Well, all MSX models carry a standard 32K ROM of BASIC interpreter, which represents quite a respectable vocabulary in itself. But this can be upgraded with an extra chip accessed by a routine in the standard ROM pack. Some firms will have enhanced ROM at launch, like the Sony with an extra 16K. Hitachi's computer will have an extra 8K, although Hitachi's debut into MSX has been delayed until April or May of next year by apparent problems with stock shortage. Sanyo is including a lightpen option in its extra ROM, while the Sony model is blessed with an extra 16K of database, which includes an address book, schedule reminder and memo pad 'firmware'.

Keyboards

MSX also uses proper push-button keyboards (though there are a couple of Japanese market membrane keyboard machines), useful amounts of RAM — most firms are including a 64K machine in their range — with at least one cartridge port that can also be used for peripherals. Up to 16 ports are theoretically possible, though a more common choice is two. In any case one-into-four adaptors will be available for particularly advanced program and peripheral juggling. So the system could hardly be described as one making a crude start or harbouring limitations for the future, says the MSX camp.

According to Mike Margolis at Sony, MSX is primarily aimed at supporting games, programming and education for the home. But it will aspire to the so-called 'entry-level' business user very soon after the initial launch. One of the points in the system's favour is its ability for any 64K machine to run converted CP/M — another 8-bit system widely used for accounting and word

processing — and program-only MS-DOS, by using an MSX-DOS adaptor and disc drive unit.

This raises the spectre of the executive loading a program from the company micro, taking it home to work on, and copying it back on returning to the office — or using a modem from home. Equally a top-end MSX machine would stand up as a business machine in its own right for those who would not normally consider a computer on the grounds of cost.

Word pro

Several companies are known to have prototypes of an 80-character MSX computer for word processing, and a UK launch next April seems likely for the model from JVC, which incidentally is a supplier of VDUs to Commodore (of all people) in the US. High resolution colour graphics is another development which could be attractive for business pie-charts — not to mention particularly exotic fun and games. A 10Megabyte/sec 'Z800' CPU chip is also thought to be under development by Z80 heroes Zilog of Silicon Valley which, if applied to MSX, would dramatically improve its capabilities.

But the most important feature for the immediate future at least is likely to be through those cartridge slots, or 'expansion ports' as manufacturers prefer to call them. Spectravideo's 80-character card for word processing is an early example of the real expansion capability of the MSX slot. As with the hi-fi and video trade, extra devices are likely to remain separate — the computer equivalent of a music centre doesn't seem very likely as far as I can tell — and MSX companies are particularly concerned that all peripherals will connect directly to their machines with the minimum of Sinclair-style adaptors and interface units.



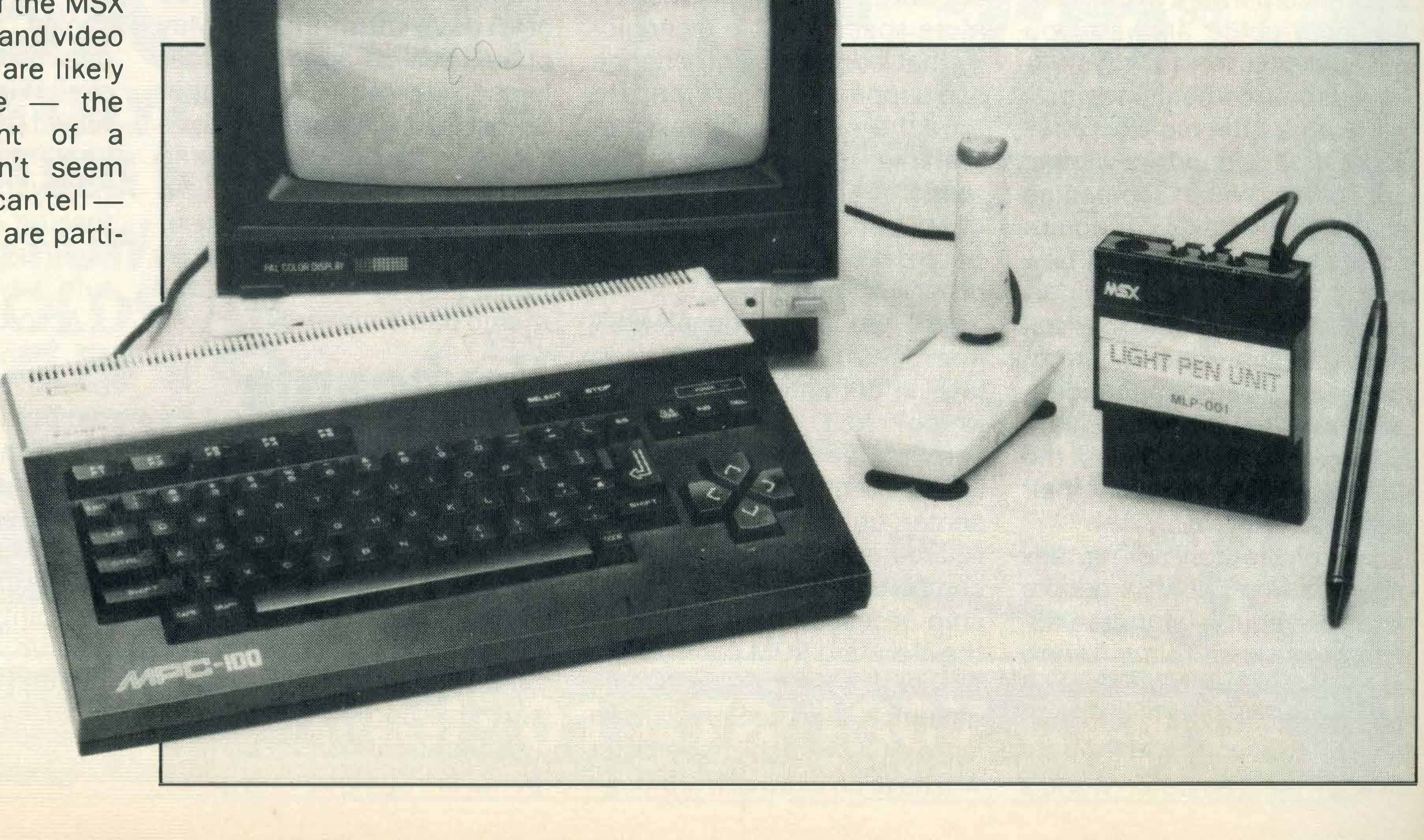
One of the more obvious peripherals is a floppy disc drive, with all the benefits of faster access time and storage capacity over the more traditional cassette tape. JVC, which already makes drives for other brands, will be introducing its own $3\frac{1}{2}$ inch and $5\frac{1}{4}$ inch units for its MSX range next year at between £300 to £400. But other storage options are also under development which in some cases are as new to MSX as any other computer system, including our high-tech mainframe, multi-screen, and mass storage brethren.



Sony already supplies several useful add-ons

For example, audio Compact Disc is being actively pursued as a low cost, high volume software storage medium by Philips of Holland. After all, it's in the home — or some at least — and the Dutch researchers who developed the system in the first place (with error correction help from Sony) are wondering why it shouldn't serve as a central resource storing some 500 Megabytes of computer programs and information, as well as audio

'A top-end MSX machine would stand up as a business machine in its own right for those who would not normally consider a computer'

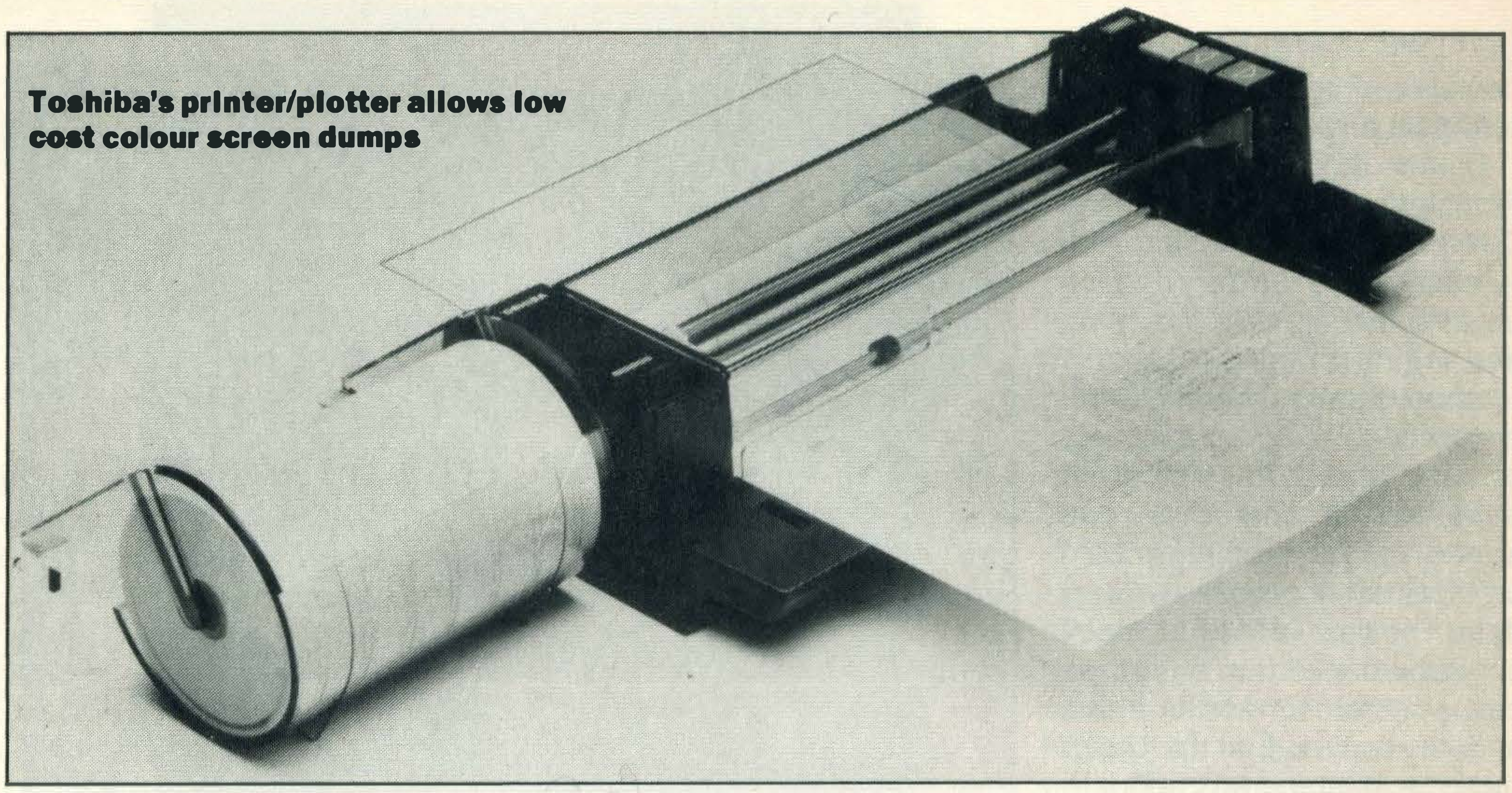


Sanyo's light pen unit plugs directly into the micro's cartridge port, leaving the expansion bus free for other add-ons

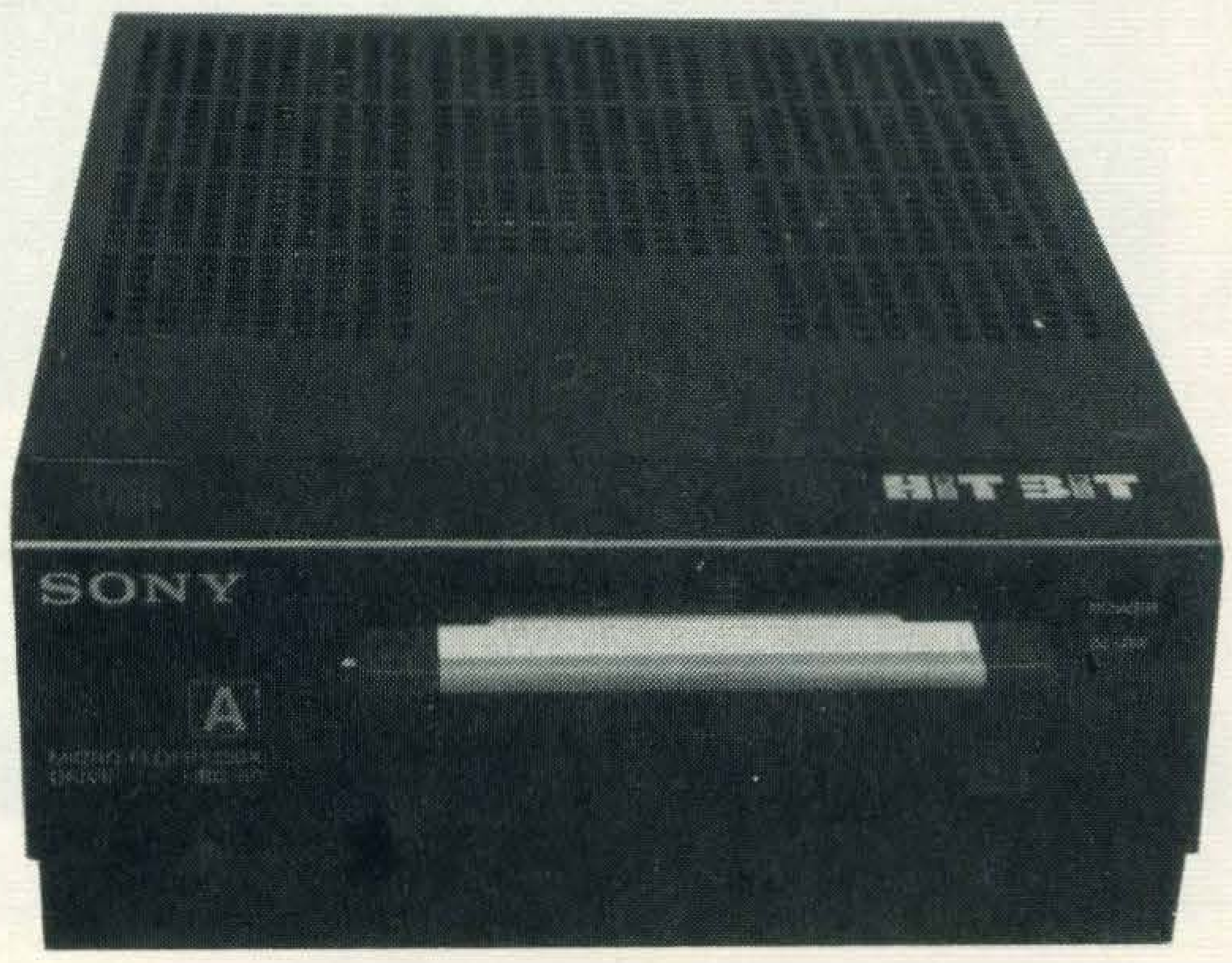
entertainment. Just recently a system showing video frames as well as digital sound was demonstrated, and the hope is to merge all these functions into one player that can be connected to the hi-fi, TV or computer — or a combination of all three.

So far Philips has perfected a related development with LaserVision, the normally-analogue audio-visual ents and training disc read by a 1mW laser through a servo tracking mirror arrangement. But 'MegaDoc' (Document) is able not only to playback a mighty 1000 Megabytes per side — about 400,000 pages of text or 25-30,000 frames of monochrome video — but it can also record. A tellium oxide sandwich between the normal outer layers of perspex changes state when the laser power is increased by some 50 times to allow recording. Digital information can be read by a solid state device (as with Compact Disc) instead of the gas laser of normal analogue LaserVision; but for recording, the power required is still too high for a solid state laser to be used at present.

Optical disk drives are slower than their magnetic contemporaries in the bulk storage business — Winchester hard disks which find data in about 30-40mS — with their access time of between 150-200mS comparing more closely with normal floppies. The recording 'melt time' is about 50nS, and



Toshiba's printer/plotter allows low cost colour screen dumps



Sony's disc drive costs a very reasonable £350



The drive takes single sided 3½ inch discs

'The recordable optical disc has to be an Important development for the future. Philips has four trials currently running in Europe with the system'

explicit track and sector data — essential to prevent inadvertent erasure of valuable information — takes up some of what would otherwise be an even more impressive capacity on a playback-only disk. But with such obvious benefits, the recordable optical disc has to be an important development for the future. Philips has four trials currently running in Europe with the system, which can record discs once only, and Matsushita (Panasonic) is in the process of refining an amorphous crystalline system in Japan which can also erase and record data discs over and over again.

Interface

Another plug-in option also concerned with memory takes a rather more conventional form, on the outside at least. It's a cartridge offering an extra 8K of RAM used with a matching ROM program cartridge inserted into the other port. One advantage of using the two together is that all the accessing instructions for the RAM pack can be written into the ROM cartridge. So a full 8K of variable data is available from



With CP/M compatibility, you can read files from floppy discs into MSX micros

the RAM cartridge, without housekeeping software cluttering up any of the capacity.

But the main benefit is this. Perching innocently on the C-MOS RAM chip is a small re-chargeable battery, which powers the constant reading and writing process necessary to store data in dynamic RAM, even when the power is turned off. The idea is that program data can be worked on and stored in the matching RAM unit for instant access at a later date. The data in the RAM pack could be backed up on a tape cassette from time to time as a security copy, rather than each time the machine was about to be switched off. Mitsubishi, which is one of the firms launching an MSX machine with only 32K of RAM this Autumn, expects to introduce 16K and 32K plug-in powered RAM cartridges next year at around £30-£40.

Other possibilities for MSX are the plug-in 'bubble' memories already found on some office machines and an electronic organ from Technics (owned by Panasonic), or the Eraseable Programmable ROM (EPROM) which can be customised with a particular program and erased by ultra-violet light through a special port in the chip casing. But these are still relatively expensive for the budget-conscious MSX group, and EPROMS need an 18V power rail and special software to 'record'.

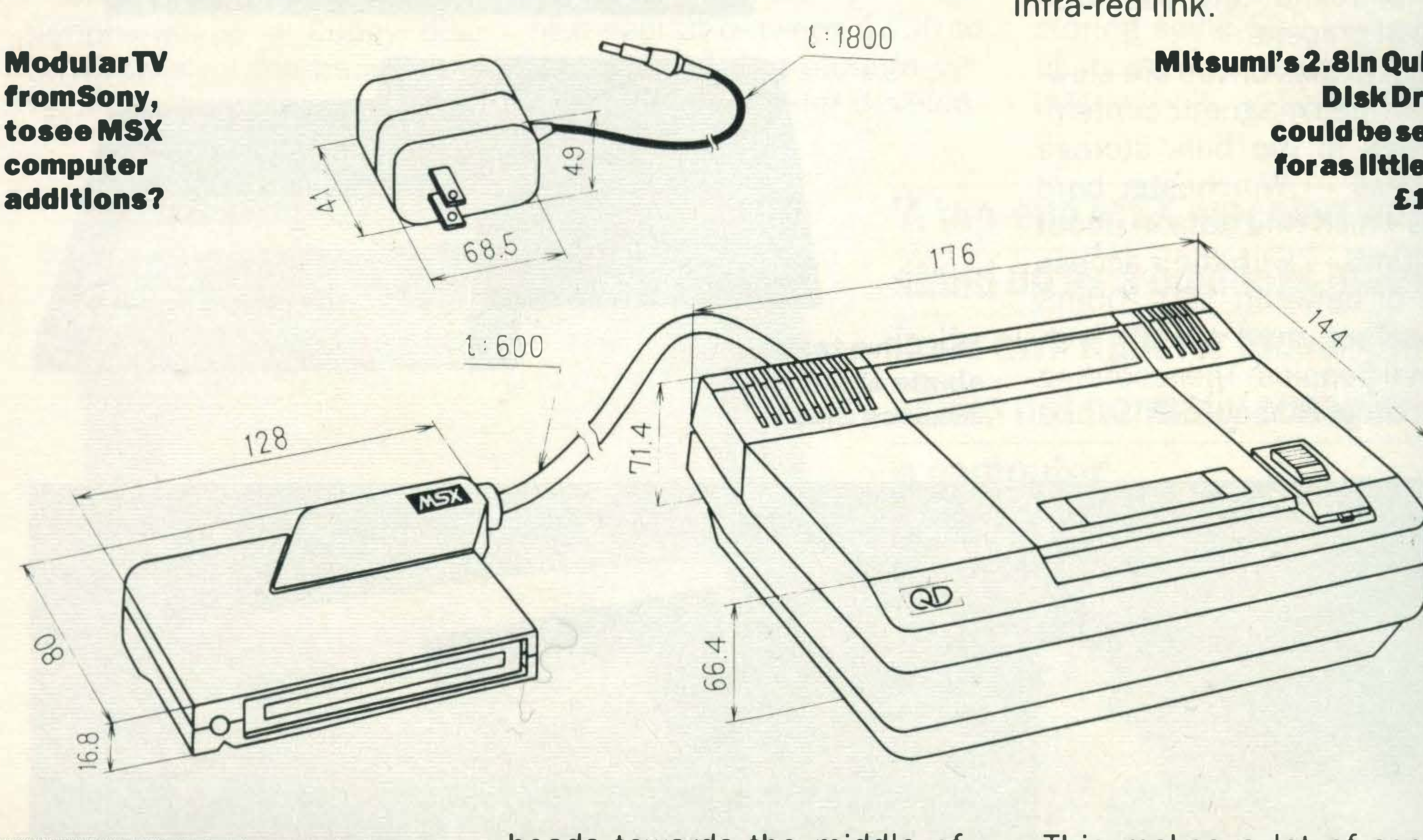
More likely as a cheap and simple storage medium is the QuickDisk shown by Toshiba and Mitsubishi in Japan and likely to emerge in the UK this time next year. It's a 2½ inch diameter magnetic disc which slots into a drive with only one motor. As the motor spins the disc, it also advances the heads towards the middle of the disc at a fixed rate. So although random access is not possible in the strict sense, it only takes seven seconds to read the entire disc capacity of 64K. Any program not selected from the contents menu at the front of the disc is simply ignored during the disc scan. It's also cheap at less than £100, and could seriously challenge the tape cassette.

But perhaps the most fascinating prospect for MSX computers is the link-up with devices which allow a practical application of computer power. As you might expect, the Japanese manufacturers are keen to match their new computers with existing products for the home where possible—whether in the hi-fi, TV and video, or music fields. Two examples in the first categories are Sony and JVC, with news of JVC's keyboard unit for next year suggesting that the company wants to move into home music-making too.

Sony is working on a particularly interesting idea which would work with its top-line 'Profeel' Component TV range initially. The Profeel system has a communications link between units which allows infra-red remote control signals to be passed around from any sensor until the right piece of equipment is found to execute that particular coded command. What the company hopes to do is link that into the MSX computer so that it can identify all the components in the system and switch the connections in accordance with a program feeding off the infra-red link.



Modular TV from Sony, to see MSX computer additions?



Mitsumi's 2.8in Quick Disk Drive could be seen for as little as £125

This makes a lot of sense when you think that with the arrival of satellite TV the single UHF socket on most sets — which already has to cope with cable, video tape or disc, and computer sources in addition to the off-air TV for which it was originally designed — will need an intelligent switching logic. Audio has had its own range of inputs for longer but now has Compact Disc, hi-fi video tapes, and video discs to contend with. Stereo cable TV and the impending stereo ter-



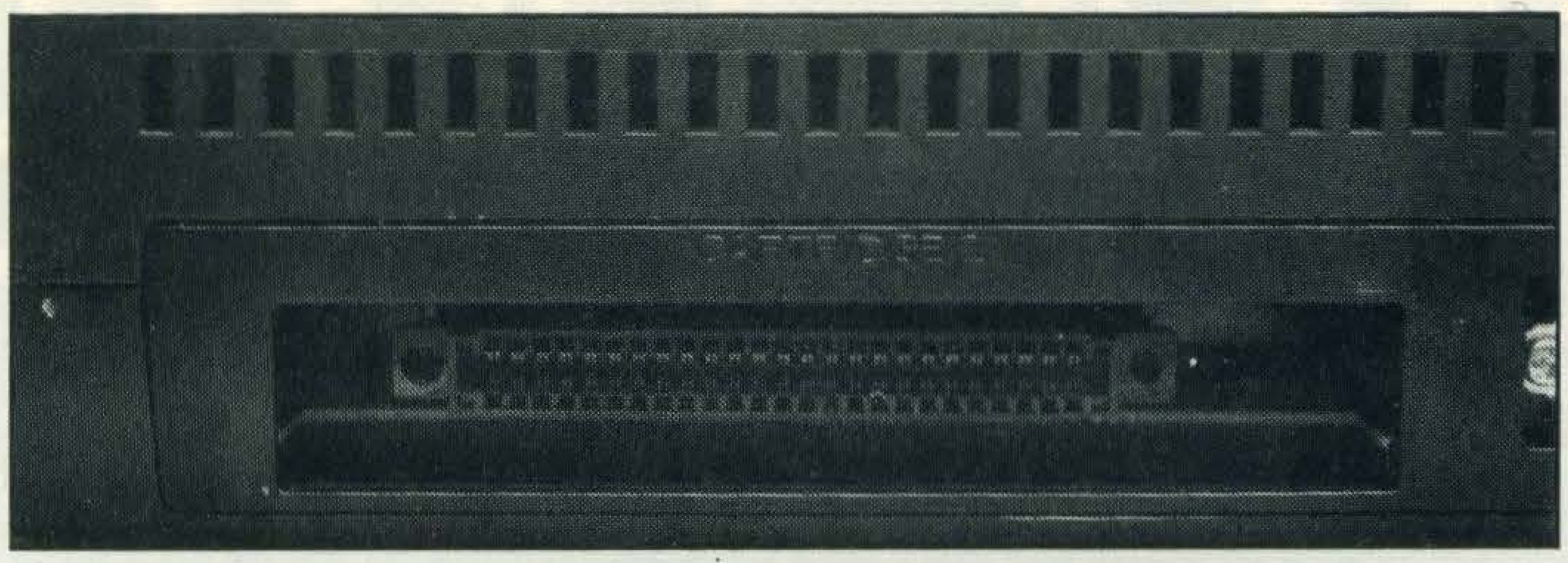
Spectravideo 80-column card —the first of many?

restrial TV will strengthen the case for an intelligent switching centre even further.

Remote handsets could also be simplified and made more powerful by the buttons being software-defined; video timer settings analysed and listed before recording; and programmes entered on a master log to create a much better organised library of time-shifted TV, home movies, and pre-recorded tapes. As co-developer of Compact Disc, Sony is also interested in expanding its role for computer program storage in the home.

JVC is following a similar line and equipping its computer with the Philips' 21-pin 'SCART' connector (sometimes called the Euroconnector). SCART has been compulsory on all TVs in France for some years and is fast becoming a *de facto* standard in Europe, with even the Japanese adopting it on their PAL TVs. One of its main advantages is the ability to cope with several inputs and outputs, and route signals around a house.

JVC hopes to interface MSX with all of these audio/visual switching requirements, but to begin with the firm will be introducing a video and computer graphics mixer aimed primarily at the home movie-maker next year. The software, built into the MSX computer as standard, will allow a limited choice of typefaces and sizes to be superimposed onto a video recording and will only add an extra £25 or so to this year's MSX launch price of £275. The video will connect to a TV via the normal UHF connector, with a SCART link between the TV and the computer, which will feed the recording machine with a captioned image. Graphics and other typefaces will also be possible, by loading extra software via one of the cartridge slots.



Every MSX micro has a 50 pin expansion slot as standard

Another option is a video editing system using a VHS recorder with something resembling time code or an accurate tape counter. As yet this exists only in prototype form in Japan, but it would allow scenes to be listed accurately and edited to that list in a similar fashion to the way that professional and broadcast TV programmes are put together.

'Yamaha's 32K MSX machine is being sold as a music-making package with a synthesiser sound producing unit and a 3½ octave keyboard'

Another creative example of applied MSX computing has been developed by Yamaha, this time for music-making. The firm's 32K MSX machine is being sold as a music-making package with a synthesiser sound producing unit and a 3½-octave mini keyboard included, with a professional keyboard available soon as an option. The Yamaha Music Computer has a 24K plug-in software package to allow synthesiser voices to be displayed graphically and programmed, with up to eight simultaneous lines of monophonic notation available for composition in the remaining 8K of RAM. According to Yamaha, that's about seven to eight minutes of 'playback' on average; or at least three minutes with every conceivable bell and whistle.

Memory

An external synthesiser can also be connected via a standard MIDI (Musical Instrument Digital Interface) interface with the same facilities, but a more colourful display of the voice parameters (normally shown singly by a small LCD on Yamaha synths) is produced. This is simply because the unit is not required to produce sound, and consequently has more capacity for graphic detail. Talking of capacity, you may wonder what use the MSX-BASIC could possibly be on a system that is clearly sold primarily as a musical tool. The answer is that Yamaha is working on a system called Music Micro, which would allow programmers to access a music synthesiser via BASIC. Will the pop records of tomorrow be plug-in cartridges, we ask ourselves. Certainly demonstration tapes could become a thing of the past.

At £599 for the hardware and a nominal £50 for the software, the MSX Music composer is bound to be a runaway success as a fully-fledged programmable synthesiser. And with an October/November launch date, who's to say we won't all be humming a 'home computer' novelty record this Christmas like German group Trio's 'Da da da' made with a hand-held Casio?



Philips' Laser Vision is now the only surviving UK-available videodisc system. Could a new lease of life be breathed into it with an MSX tie up—Philips have MSX plans for Europe

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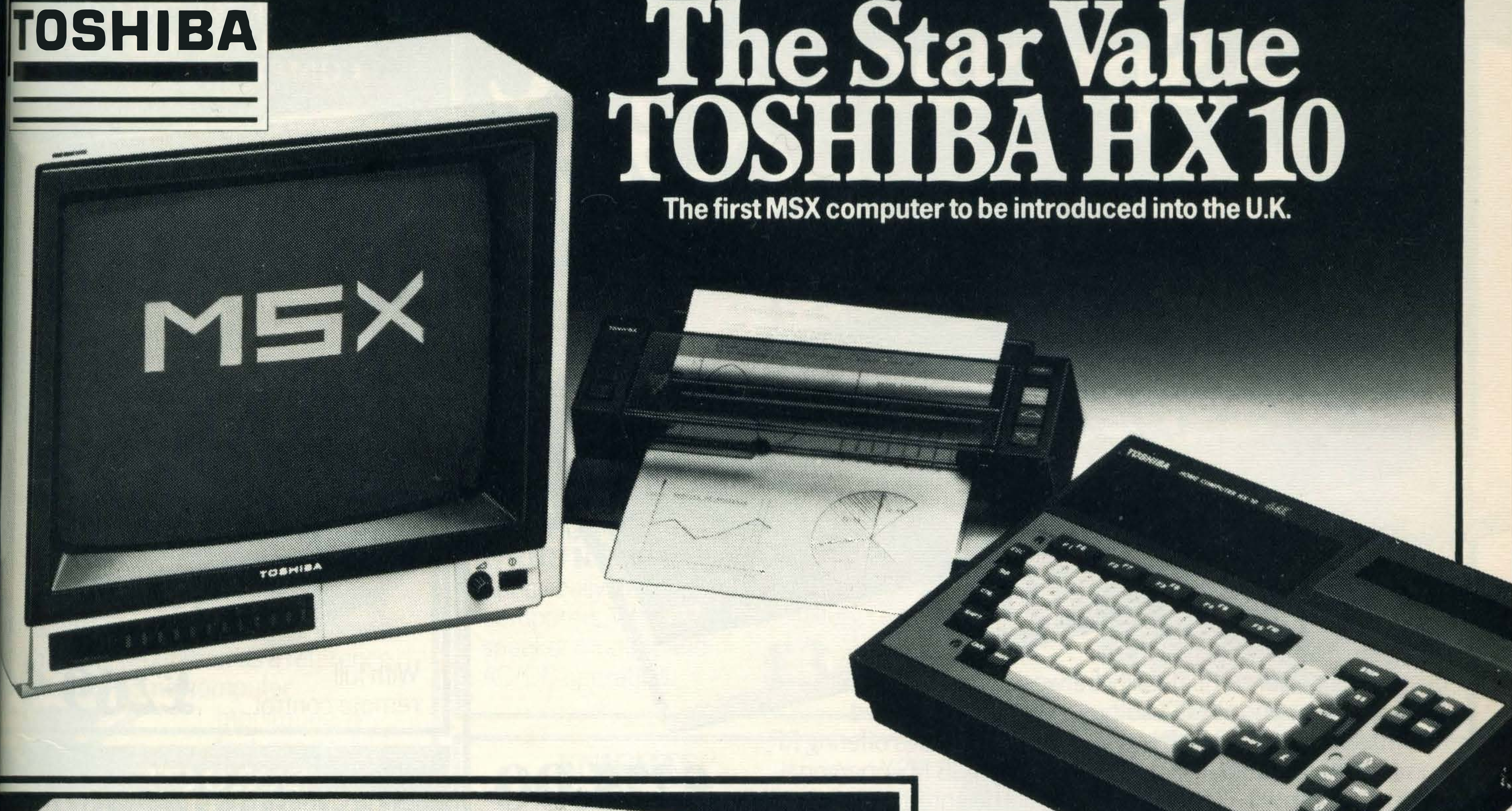
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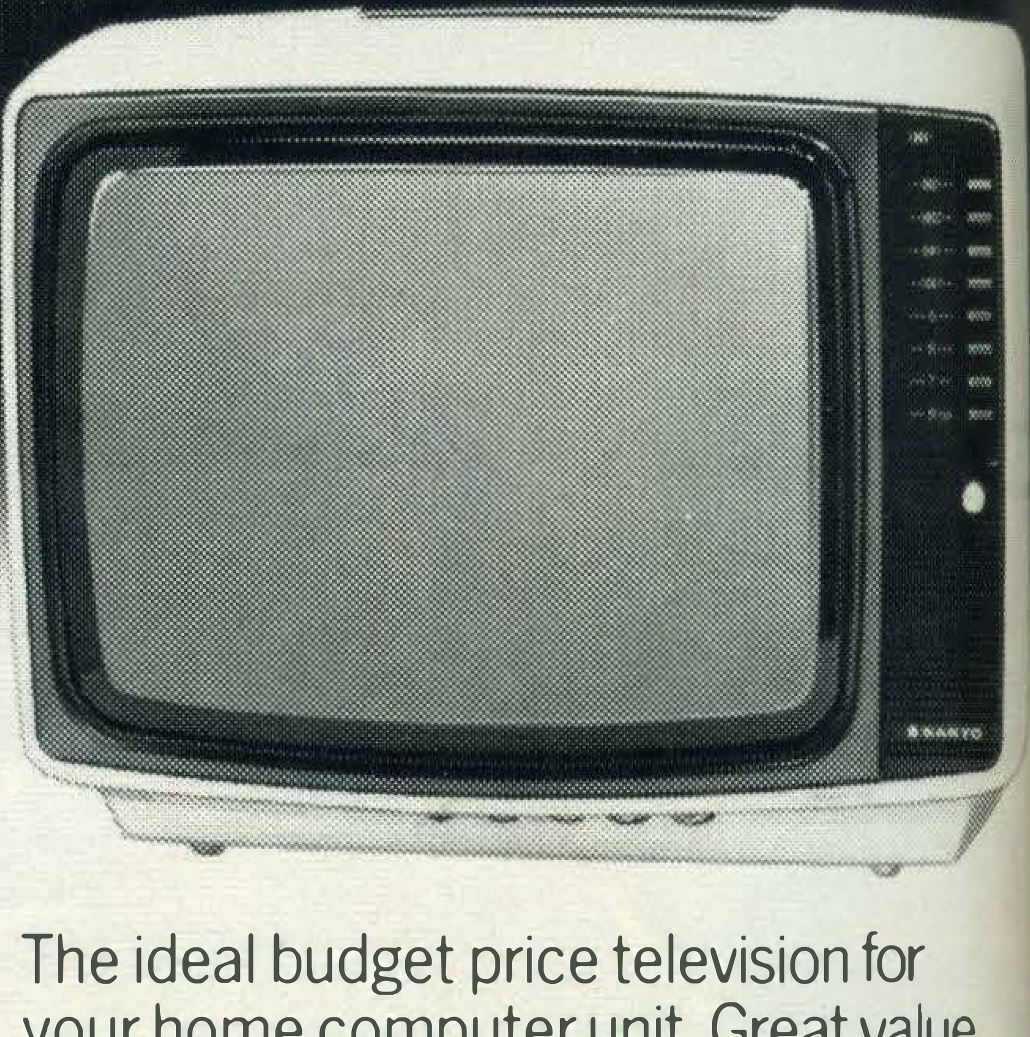
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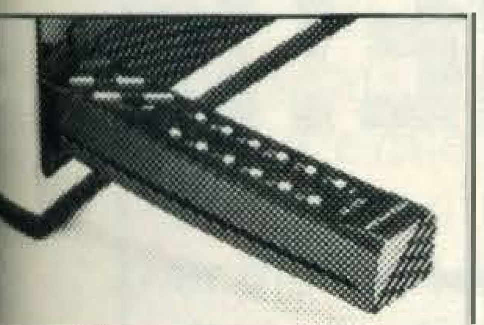
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The **"CHESHIRE CAT EDUCATIONAL SERIES"** of programs will be made available to MSX users.

ABOVE ARE ONLY A FEW OF THE MANY PROGRAMS AVAILABLE FOR YOUR MSX BY MAIL ORDER OR FROM YOUR LOCAL STOCKIST.

DON'T FORGET TO ASK YOUR DEALER FOR DETAILS OF CREDIT FACILITIES, EXTENDED GUARANTEES, ETC. AVAILABLE ON CERTAIN ITEMS.

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What MSX?

Over the next 12 pages you'll find all the information you need to build up a complete MSX system

Confused by computers? Puzzled by peripherals? Stonkered by software? Here are the answers — or at least the information that will get you on the right track. This is as comprehensive a guide as has been humanly possible to compile to the MSX computer scene. It details machines, peripherals and programs that are, or are due to be, available.

It is divided into six sections, over the next 15 pages.

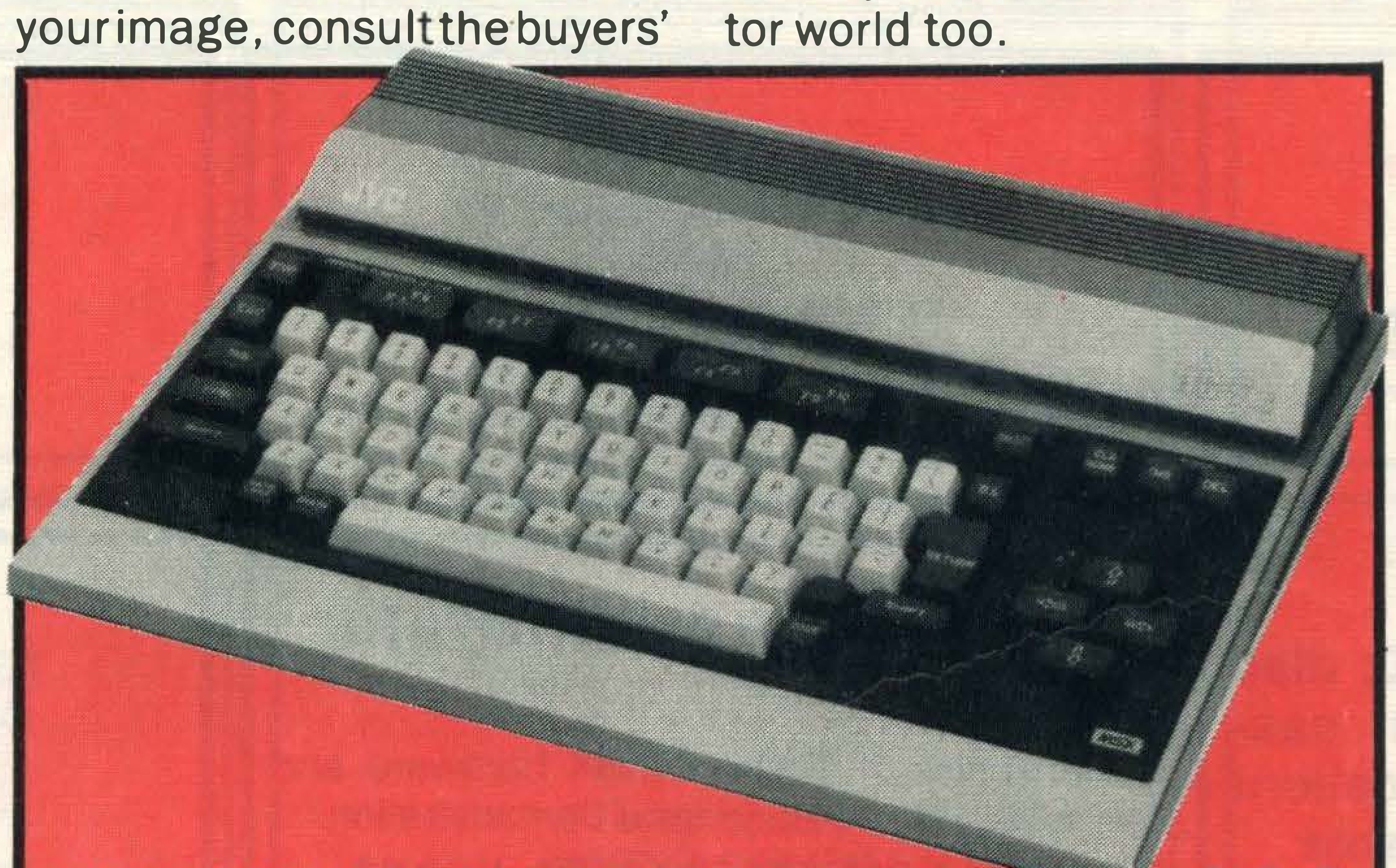
We kick off with a diagramatic overview of an MSX computer system — what plugs into what, what different things to do and so forth. Be warned, there's no such thing as a complete system. You'll be bankrupt before you get anywhere near buying all the things that you can use with your MSX computer.

The first main listing is a comparative chart of all currently available MSX computers. Most are reviewed in this issue of What MSX? The comparative table shows how they stack up against each other for price, features and so forth. You should be able to compile a shortlist if you haven't already settled on a favourite machine.

The next listing is of MSX peripherals. These are the pieces designed exclusively for MSX computers. You'll find details of disc drives, light pens, speech synthesisers, touch pads, communications hardware and much more.

If you're a games player, you must consult the buyers' guide to joysticks. Here you'll find details of all kinds of joysticks, including paddles, remote control units, trackballs and so forth. The aliens will never stand a chance!

To improve the quality of your image, consult the buyers' guide to monitors. We've the facts on just about every monitor costing less than £500. If you think that your games look good on the domestic television, wait till you see what a monitor does to them. We've got a full explanation of the terms you'll meet in the monitor world too.



For hard print, the buyers' guide to printers has all the hard facts. Over 100 printers are listed, costing up to £1,000 or so. Some are super fast, others offer super quality. Some do colour, some run silently. Some can be used as an electronic typewriter, others as viewdata terminals. There's a tremendous variety of printers to choose from, and this guide should put you on the right path.

The last section of the Buyers' guide lists MSX software. Some of it may not be available immediately, but is promised before the end of the year.

As there are so many software packages available, we've grouped them into categories. These are games, education, business, utility and other. We've listed the supplier of each package, and you'll find addresses and 'phone numbers of suppliers. Some of the software may not be available through your local MSX dealer, so you may have to order direct.

Prices throughout are approximate only. Peripherals may be discounted, particularly if they are popular and widely available. Some software companies hadn't settled on firm prices by the time we went to press, and details on some of the MSX peripherals were rather sketchy. Check with suppliers if you have any queries.

General advice to readers concerning advertisements

When replying to advertisements in this issue, you should note the following points:

1. Always clarify the exact nature of any guarantee being offered.
2. Never send cash — always a cheque, Postal or Money Order.
3. Insist on a written receipt.
4. Clearly state the equipment you seek, and detail any acceptable alternatives.
5. Request an immediate statement of how and when the goods are to be delivered and whether the delivery will be split.
6. Check by telephone the latest prices and availability of goods you are ordering.
7. Cases of non-supply or wrong supply of goods should initially be taken up directly and as soon as possible with the supplier.
8. Because of fluctuations in prices and discounts, it is advisable to ensure that you reply only to advertisements published in current issues.

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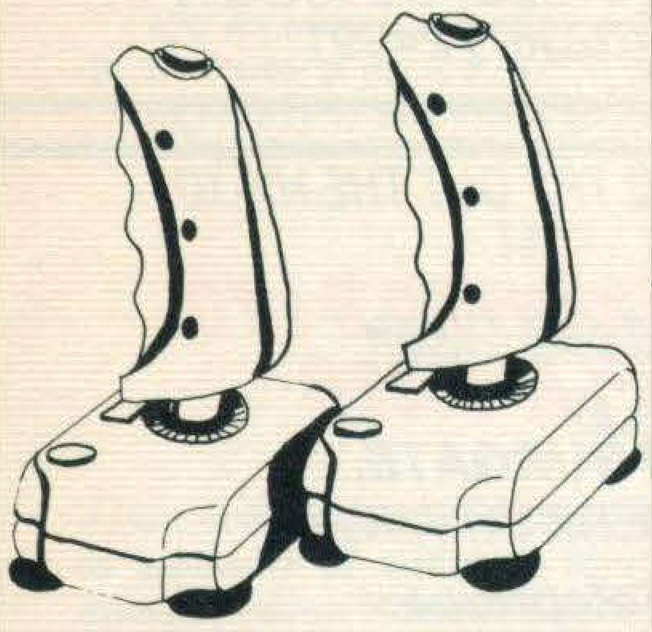
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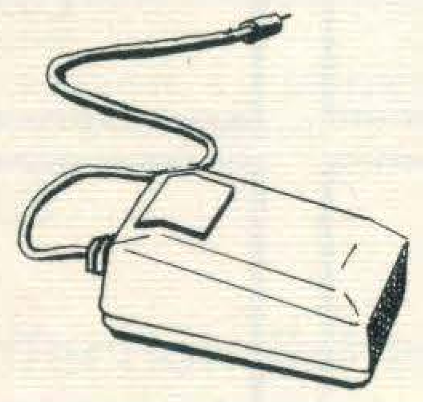
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TALKING COMPUTERS



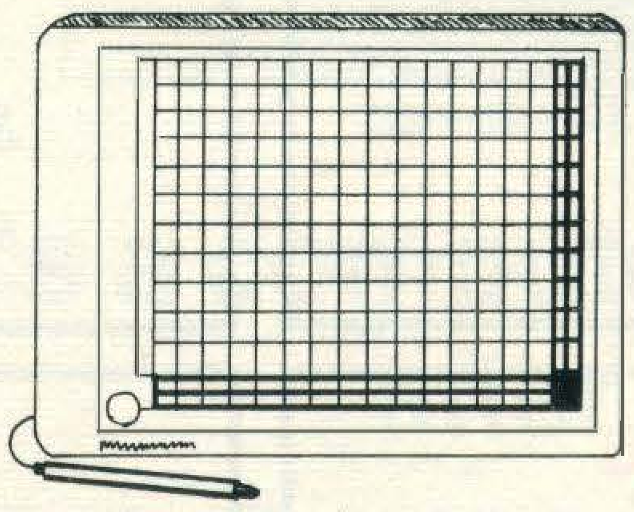
JOYSTICK
The most popular games controller, the joystick has one of two fire buttons and relays the player's movements to the computer. Some joysticks are available with continuous fire buttons for the cheats among us!



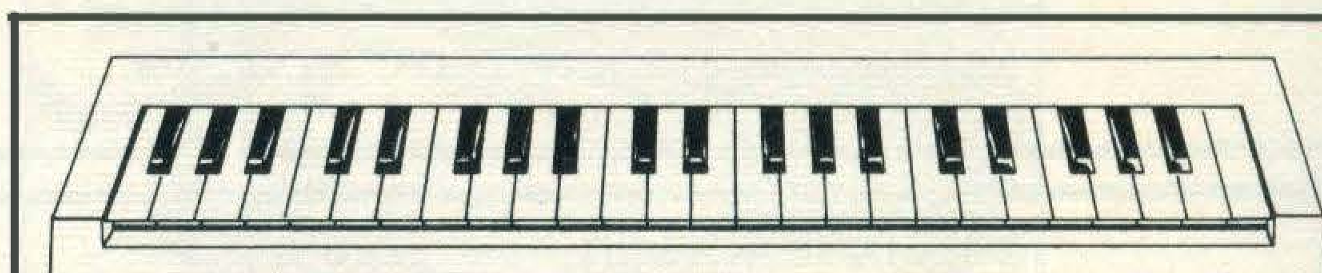
MOUSE
An alternative way to control the screen cursor. Works rather like a 'rolling joystick', the mouse's movements over your desk top are mimicked by the cursor on the screen. Good for building graphics.



LIGHT PEN
The light sensitive element at the end of a light pen sends signals to the computer via a modulator which interfaces through the cartridge port. Light pens can be used for educational games, graphics or any program which involves selecting from lists (menu driven).

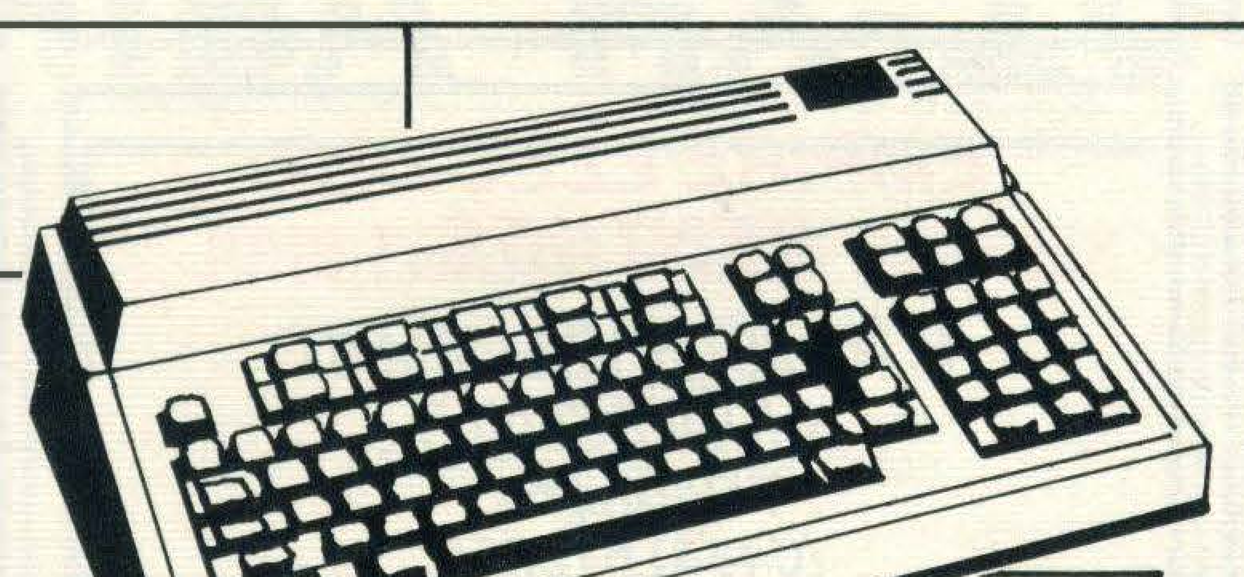


GRAPHICS TABLET
The computer equivalent of the Etch-A-Sketch! The stylus is used to draw lines on the tablet proper while the palette is used to choose colours and hatch patterns for outline filling.



MUSIC KEYBOARD
To enable computers to have quick access to music without the problems of coding or notation some manufacturers are producing 2½ or 4 octave keyboards which will plug in to interface cards for the MSX expansion bus.

INTERFACES
The 50pin input/output socket (**expansion bus**) on the MSX computer offers expansion possibilities through the use of dedicated plug-in modules. Called 'cards' these circuits can either expand the operation of the micro (an 80 column card for word processing or a data cartridge) or enable the computer to be interfaced with specialised input devices, light pens, music keyboards etc.



LANGUAGES
Computer languages are coded instructions. There is a wide variety of languages available each with its own application. MSX BASIC spoken here!

High level languages are computer languages easily understood by you and I but not by the processor.

Low-level languages (like machine code) are much closer to the language of the processor but are difficult to read by humans and hard to edit. The benefit of programming in a low level language is the higher speed at which it runs.

BASIC. This stands for Beginners' All-purpose Symbolic Instruction Code. Though developed as an introductory language it has now become one of the most widely used languages for home computing. Various dialects exist.

MSX BASIC. This is the extended version of BASIC written by the MicroSoft Corporation as used on all MSX computers.

ASSEMBLERS etc
Assembler. Correctly called assembly language, this exists between the high level programming language and machine code which it generates. Assembler carries over some of the benefits of a high level language (labels etc) yet is fast to run.

Compiler. This is a program which translates your program into machine code—permanently. Compiled programs are quick to run but very hard to edit.

Interpreter. Unlike the compiler, an interpreter translates your program into machine code one line at a time. This makes programs slower to run but relatively easy to edit.

CPU
The **Central Processor Unit** is simply a vast array of electronic switches which can either be on or off. These two states are represented by binary (base two) notation; there are two binary digits (**bits**), namely 0 and 1.

Machine code. This is the language of the processor. This is called a low-level language because it is removed from the quasi-English of a high-level language like BASIC.

MEMORY
RAM (Random Access Memory) the amount of memory quoted in K (Kilobyte).

ROM (Read Only Memory) this is the memory 'set up' by the manufacturer. Video functions and the MSX Basic languages are stored here. Like RAM this is quoted in K.

Byte. Memory is determined by the number of characters which can be stored. A character is coded by an 8bit binary word which is called a byte.

Kilobyte. As computer mathematics are binary (to the base of 2) the nearest binary number to 1000 is 1024. 1024 Bytes make one Kilobyte.

User RAM. Computers tend to use a lot of RAM when asked to generate high resolution graphics, to run other languages or specialised peripherals. User RAM is what's left over for your programming.

KEYBOARD
The Keyboard is the traditional interface between humans and the computer. The standard QWERTY layout is supplemented by some special keys on the MSX keyboard. The **function keys** marked F1-F10 allow complex commands to be entered at one key stroke.
Four **cursor keys** are used to move the cursor up, down and across the screen. Some games programs can be played with just the cursor keys and require no joystick control.

A **GRAPH** (Graphics) key allows the QWERTY keyboard to enter symbols with one key stroke. The GRAPH key works like the SHIFT key.

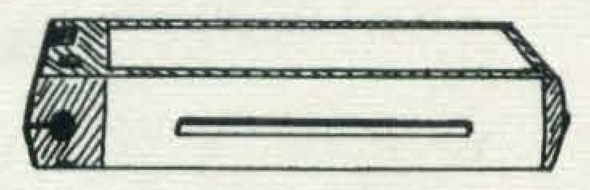
The full 73 key set is made up with four keys which allow insertion and deletion, one which returns the cursor to the top left of the cleared screen and one, SELECT, which is of use in WP and data entry programs but has no use in BASIC.

GENERAL
Software is the general term for computer programs. **Hardware** is everything else, the processor, keyboard etc. **Firmware** is software stored in a 'hard' form, cartridges and ROM chips are good examples.

Peripherals. The bolt-on goodies. This term covers, printers, plotters, joysticks, monitors and the like.

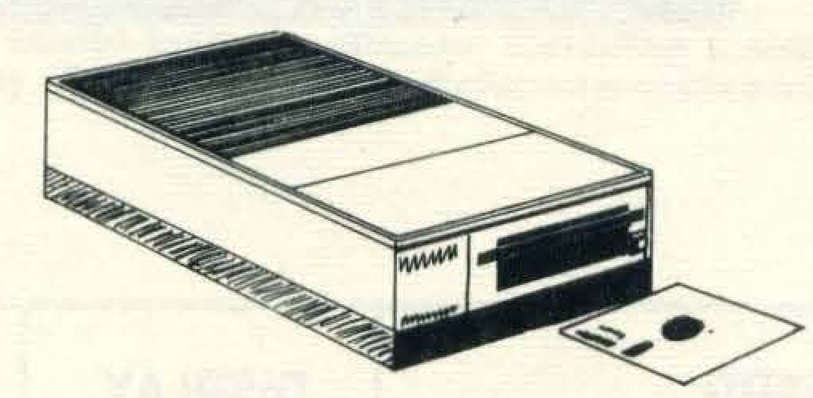
VDUs. A general term for a visual output; stands for Visual Display Unit and covers monitors, and TVs.

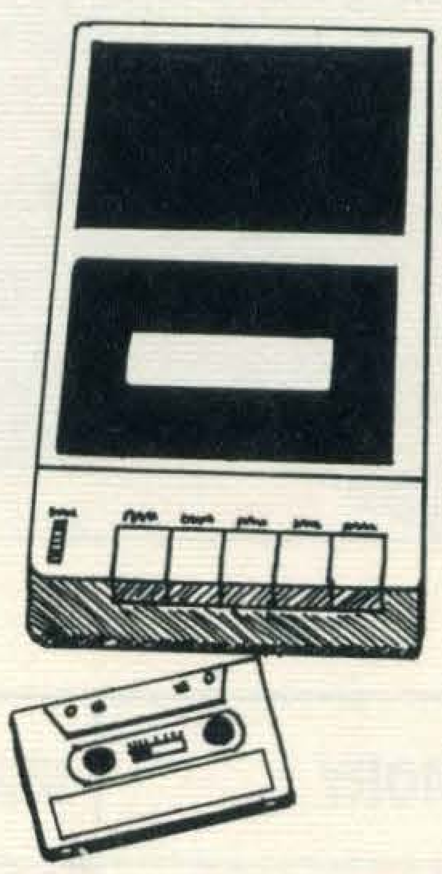
CARTRIDGE
The quickest way to load a program, but as yet the most expensive. Programs are permanently stored on a micro chip in the cartridge case which interfaces through a 50 pin cartridge socket.

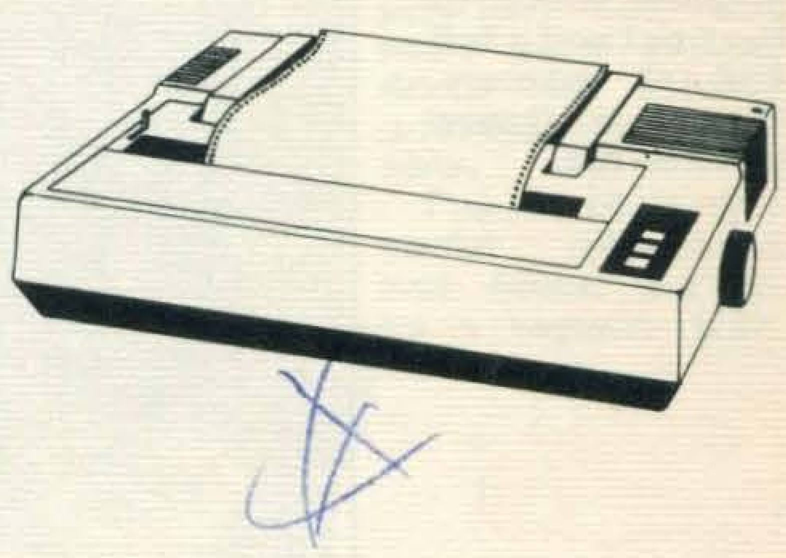


DATA STORAGE AND RETRIEVAL
Discs and **Compact Cassettes** are the most common forms of permanent data storage. Both are magnetic record/erase devices. Discs offer faster access to a greater amount of stored information. Cassettes are slow but cheap.

Discs are divided up into tracks and sectors. The computer needs to know where data has been stored; this 'housekeeping' function is run by a program called the Disk Operating System (**DOS**). The **MSX-DOS** (Micro-Soft Extended Disk Operating System) is used by MSX machines. **CP/M DOS** (Control Program for Micros) is data compatible.







PRINTERS AND PLOTTERS
Dot matrix printers build up the patterns of letters and characters by a bank of pins striking through an inked ribbon. Print quality varies from terrible to good.

Daisywheel printers are named after the spinning disc which carries the type elements on its spokes. The very highest print quality can be achieved but speed and character set is often limited.

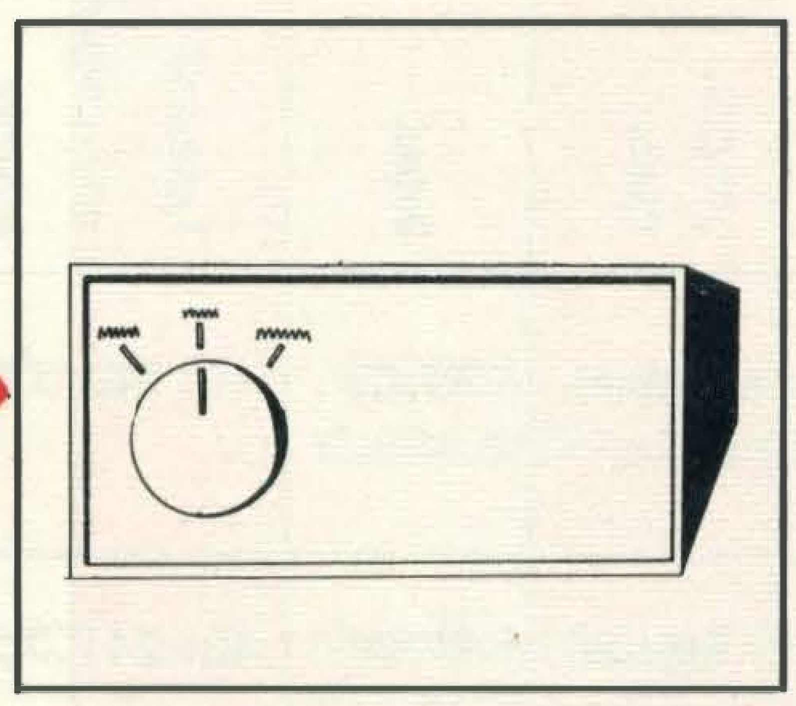
Plotters. These draw graphs and diagrams with a pen and can be either of the flatbed or platen type. A choice of pen colour is often offered.

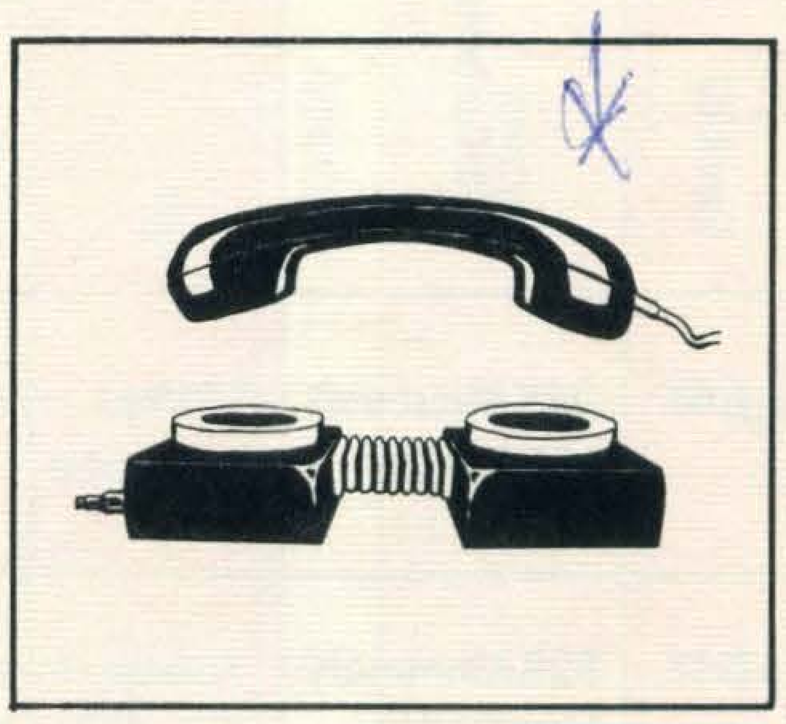
Thermal printers. These offer fast, quiet but limited quality print often on especially treated paper which reacts with heat to show visible lettering. Material costs and print quality are often a deciding factor against such printers.

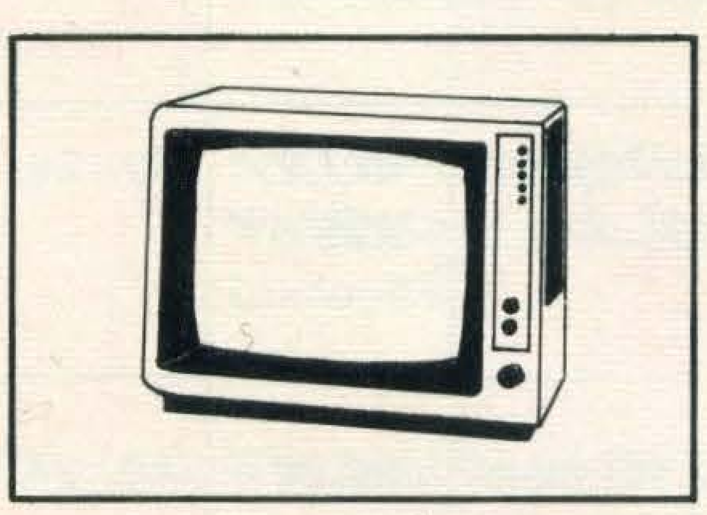
DATA TRANSMISSION
Computers can be networked to enable one user to talk to others individually or together through 'electronic mailboxes'. The telephone system can be used via special adapters to let one computer talk to others.

Modem stands for Modulator/Demodulator, a Modem turns the telephone system into a giant cable between distant computers. The Modem is a 'black box' which converts the low voltage digital signals from the computer into an analogue signal which can be transmitted over the 'phone system.

An **Acoustic Coupler** is a more portable and often cheaper way of interfacing a computer with the 'phone network'. Here the computer output is used through a modulator or to drive a telephone handset through a microphone and loudspeaker. Portable couplers offer the businessman instant access to his data base back at the office.

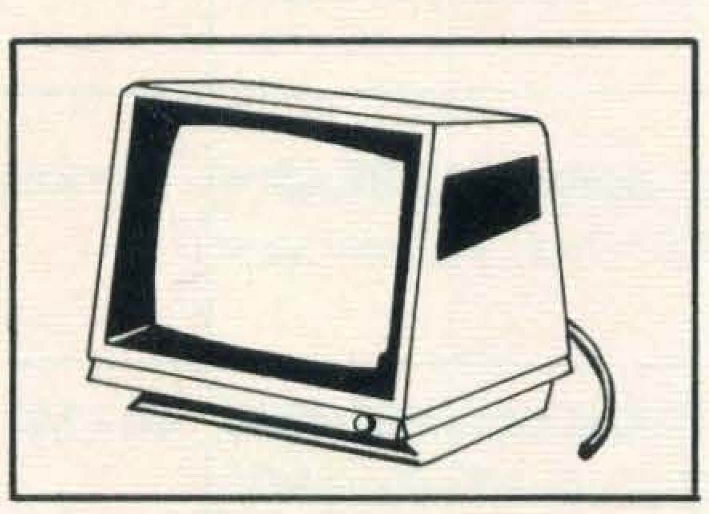




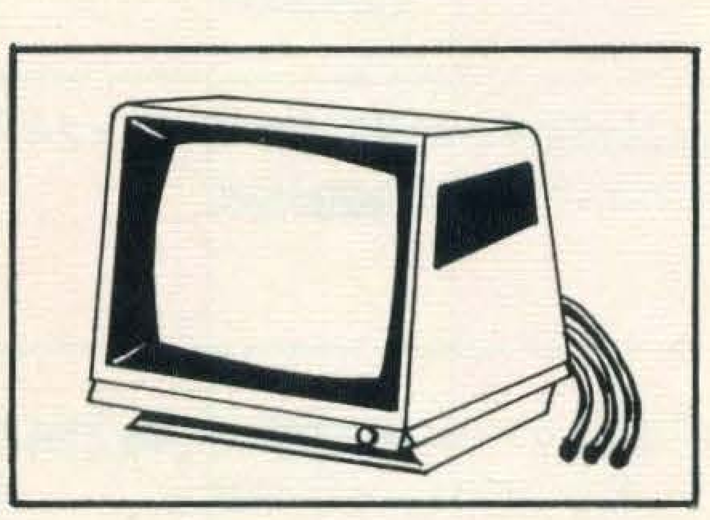


GETTING A PICTURE
All MSX computers will give sound and pictures from a standard **TV** set through their UHF output. A dedicated **monitor** will give better resolution from the video output while the audio output can be taken to a hi-fi system if the monitor has no built in loudspeaker. **RGB** outputs allow individual control over the Red, Green and Blue electron guns in the monitor colour and can be used to produce high quality graphic images.

TEXT
Computers are frequently used for **word processing**, to write letters or reports. Most text displays give 37 characters (or 40) by 24 lines. Real word processor packages reform the text screen to 80 characters (some to 64 characters wide). Powerful editing facilities enable the user to delete and insert words, phrases or paragraphs, to search for and correct spelling. Dictionary programs can also be bought.



AUDIO AND VIDEO





SOUND
Computers have conventional audio outputs which can be used to drive the tape or tuner input of any hi-fi system. MSX computers have three separate channels of sound, and a fourth channel of noise. Stereo outputs are possible. A computer can be used to define the precise waveform of a sound just in the manner of a synthesiser.

GRAPHICS
The smallest unit of 'graphic information' is the **pixel**. This can be thought of as the dot from which graphics can be built up. The MSX system uses a screen of 49152 pixels arranged in 256 columns of 192 lines.

Sprites are independently programmable groupings of pixels which form a recognisable character which can be 'addressed' around the screen.

16 colours are available to the programmer working in MSX.

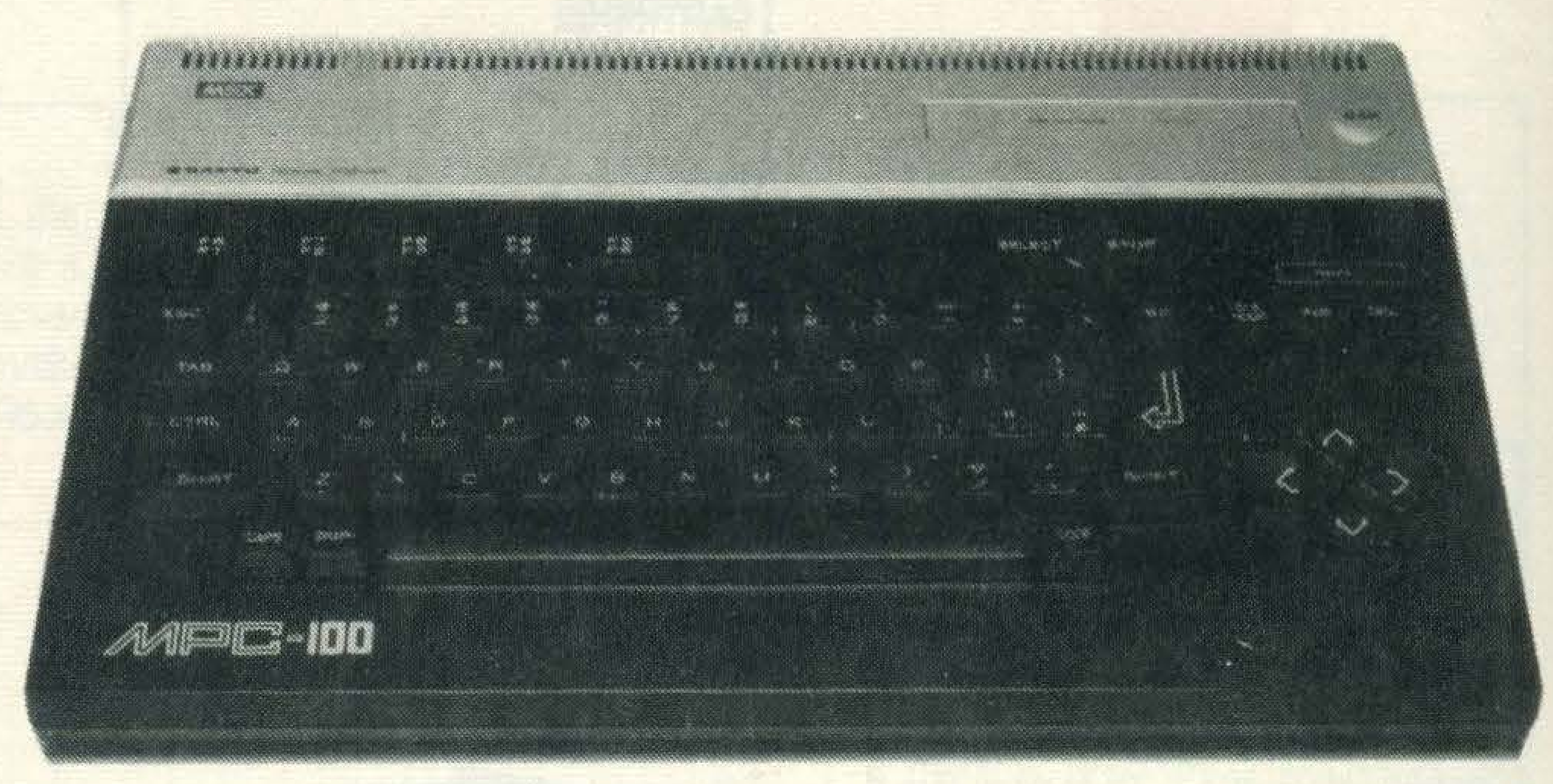
Canon V-20
£280

Canon are a well known office machine and camera manufacturer. Their first MSX computer is a good looking machine with an excellent cursor keypad. It has joystick ports in the front and a full 64K of memory. There's a Canon joystick too.

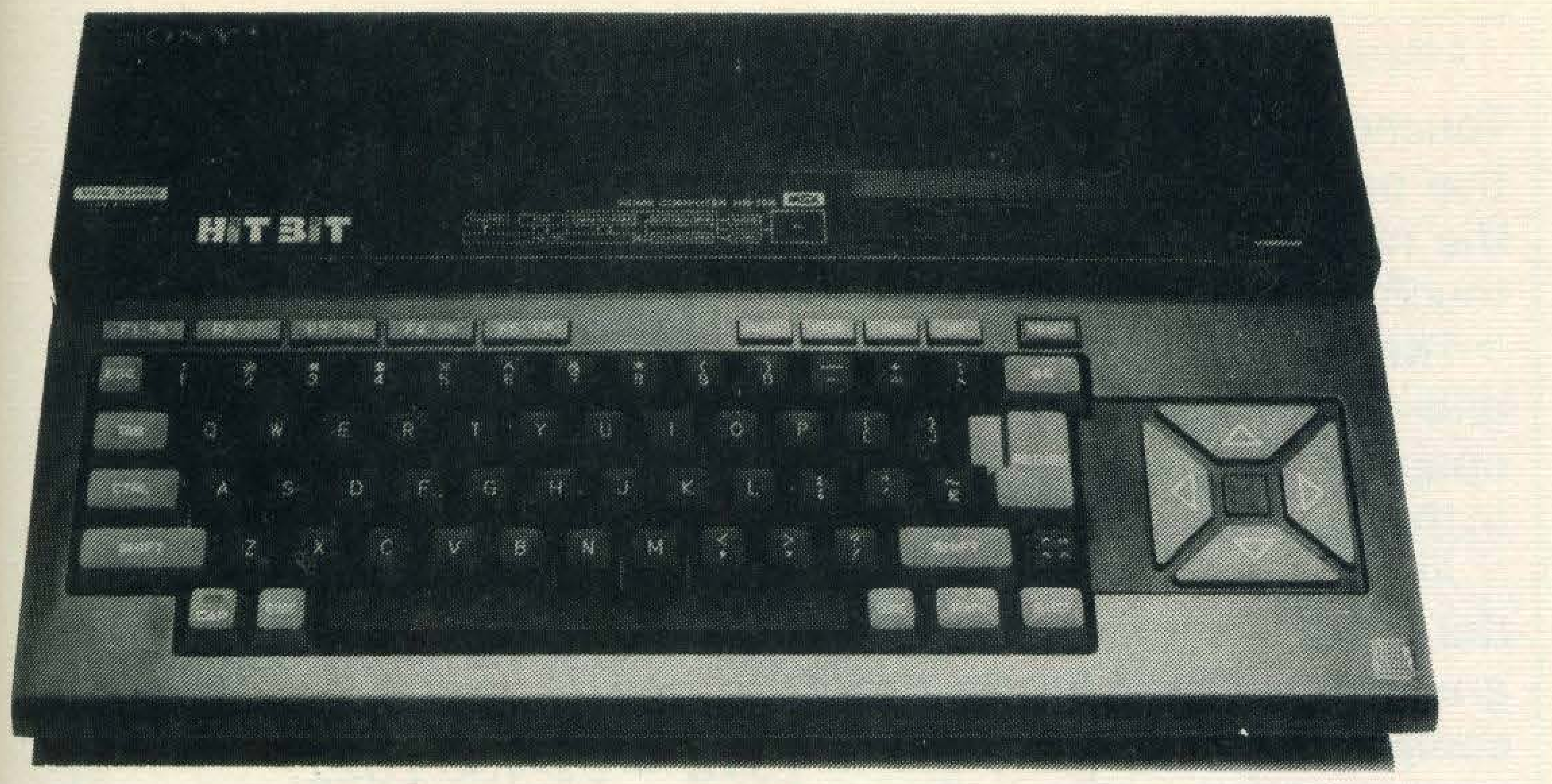


Sanyo MPC-100
£300

On test the Sanyo MPC-100 proved an impressively well-built micro though nothing exceptional was provided in the way of facilities. Sanyo are about to launch their MLP-001 light pen unit which will plug directly into the cartridge socket. For computer art buffs this accessory will be top of the shopping list.



COMPUTER			MEMORY			KEYBOARD				DISPLAY		INTERFACES					
Maker	Model	Price	Total RAM	User RAM	ROM Contents	Type	Numeric Keypad	Cursor	Output	Text format	Joysticks	Expansion bus	Cartridge port	Printer	Serial port	Cassette	Output
Canon	V-20	£280	80K	64K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	—	2	Centronics	—	DIN	Mo
Goldstar	FC-20	£240	80K	64K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo
JVC	HC-7	£279	80K	64K	32K Microsoft MSX BASIC	72 key, full stroke	No	Keypad	RF, CV, RGB	40×24	2	—	2	Centronics	—	DIN	Mo
Mitsubishi	MLF-48	£249	48K	32K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo
Mitsubishi	MLF-80	£299	80K	64K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo
Sanyo	MCP100	£300	80K	64K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo
Sony	HB-75	£299	80K	64K	32K Microsoft MSX BASIC Sony Firmware	75 key, full stroke	No	Keypad	RF, CV, RGB	40×24	2	—	2	Centronics	—	DIN	Mo
Spectra-video	SVI-728	£250	80K	64K	32K Microsoft MSX BASIC	90 key, full stroke	Yes	Keys	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo
Toshiba	HX-10	£279	80K	64K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo
Yamaha	CX5M	£599	80K	64K	32K Microsoft MSX BASIC	73 key, full stroke	No	Keypad	RF, CV	40×24	2	Yes	1	Centronics	—	DIN	Mo



Sony Hit Bit HB-75B
£300
Sony's Hit Bit computer comes with some very useful built-in software, including a small address book. That makes it worth the extra money. It is also a superbly finished machine with all facilities and a fabulous keyboard.



Toshiba HX-10
£279
Toshiba's is one of the first MSX micros on the market and will be widely available through many High Street multiples. It is being launched with a matching joystick, and will soon have a disc drive, 80 column printer/plotter available.
The HX-10 is colourful, mid-priced and looks set to be a popular MSX machine.

SOUND	OTHER								
Built-in speaker	Reset button	Built-in storage	Power supply	Software supplied	Accessories supplied	Distributor	Availability	Reviewed	Comments
No	No	No	Built-in	None	M(2), C, T	Canon (UK) Ltd, Waddon House, Stafford Rd, Croydon CR9 4DD		Nov'84	Excellent cursor keypad, good styling
No	No	No	Built-in	T.B.A.	M, C, T	Microdealer (UK) Ltd, 29 Burrowfields, Welwyn Garden City, Herts AL7 4SS	600	—	Super value, Korean-made machine
No	Yes	No	Built-in	T.B.A.	M, C, T	JVC, JVC House, 12 Priestley Way, Eldon Wall Trading Estate, Staples Corner, London NW2		Nov'84	Stylish, and with matching peripherals
No	No	No	Built-in	Demo, 4 games	M, C, T	Mitsubishi Electric (UK) Ltd, Otterspool Way, Watford, Herts WD2 8LD		—	Less memory, and a lower price
No	No	No	Built-in	Demo, 4 games	M, C, T	Mitsubishi Electric (UK) Ltd, Otterspool Way, Watford, Herts WD2 8LD		Nov'84	Plain, unpretentious, from a major manufacturer
No	Yes	No	Built-in	Demo, 3 games	M(2), C, T	Sanyo Marubeni (UK) Ltd, Sanyo House, 8 Greycaine Rd, North Watford, Herts WD2 4UQ		Nov'84	Well made and well designed machine
No	Yes	No	Built-in	T.B.A.	M, C, T	Sony UK Ltd, Sony House, South St, Staines, Middx TW18 4PF		Nov'84	Built-in software is excellent
No	No	No	External	None	M, C, T, Transformer	Spectravideo Ltd, 165 Garth Rd, Morden, Surrey SM4 4LH		Nov'84	Numeric keypad gives business appeal
No	No	No	Built-in	Demo	M(2), C, T	Toshiba Ltd, Toshiba House, Frimley Rd, Frimley, Camberley, Surrey		Nov'84	Widely available, mid-priced machine
No	No	No	External	Voicing prog	Synthesiser keyboard, M, C, T	Yamaha-Kemble Music (UK) Ltd, Mount Ave, Bletchley, Milton Keynes MK1 1JE		—	More a synthesiser with MSX computer

INTERFACE BOARDS

Kuma's RS232C interface board costs £99.50.

It provides independent transmit and receive channels including all standard handshaking signals. It will also act as a printer port within a program.

Kuma also has a parallel interface board which plugs into the ROM slot. It provides the following options; 3 × 8 bit ports with full handshakes, bit set and reset and a 1 × 8 bit bi-directional port.

The board is based on the 8255 TTL compatible chip and retails at £59.50.

Kuma Computers — (07357) 4335.

The IF 7610, **JVC's** RS232C interface board will be available by November for a price below £100.

ROM software with extended BASIC comands has been built into the board for communication purposes. A terminal emulator, also built in, can be accessed with BASIC commands.

The board acts as a printer port and has the standard RTS and CTS handshake signals, a 25 pin plug as well as transmit and receive channels.

JVC — 01-450 2621.

COMMUNICATIONS

For £135, **Farmfax** or **Computer Mates** as it is sometimes known provides a modem with a word processor as well as communications software built in.

The modem is connected to a cartridge which plugs into the computer's cartridge port. All information can be stored permanently on either a Sony RAM pack or Farmfax memory box cartridge.

Features include an automatic log on procedure and full off line editing.

The modem will connect to Prestel and most of the electronic mailing systems such as Telecom Gold.

Farmfax — (0264) 810824.

A communications package which allows access to services such as Prestel, Viewdata, Telecom Gold, British Telecom and Homelink is now available from **Kuma Computers** for £19.95.

It needs a modem and an RS232C card such as Kuma's own card. Software can be downloaded for use with telesoftware and Viewdata frames can be saved, viewed and printed from both tape and RAM disks.

Messages can be prepared off line and then recalled for transmission. Two-colour graphics are included in the package.

Kuma Computers — (07357) 4335.

LIGHTPEN

A lightpen is essentially a pen with a light detector positioned at the tip.

As yet, **Sanyo** is the only MSX company to have produced a lightpen — the MLP001 which costs £89.95.

The pen is attached to a cartridge via a cord and the cartridge itself plugs into the computer cartridge port.

The graphics package available with the pen utilises a 16 colour palette. It can also be used with business packages or games.

Sanyo Marubeni Ltd, — (0923) 46363.

80 COLUMN CARD

The 40 column display generated by some of the MSX computers can be increased to 80 columns with an 80 column card.

One of the main advantages is that the CP/M packages can be used.

Spectravideo's 80 column video cartridge, the SV1-727, is the only one available at the moment and costs £112.79. The card is available with a video cable.

The cartridge fits into the computer's game slot. One end of the video cable plugs into the cartridge and the other end goes into the monitor.

Spectravideo — 01-330 0101.

TOUCH PAD

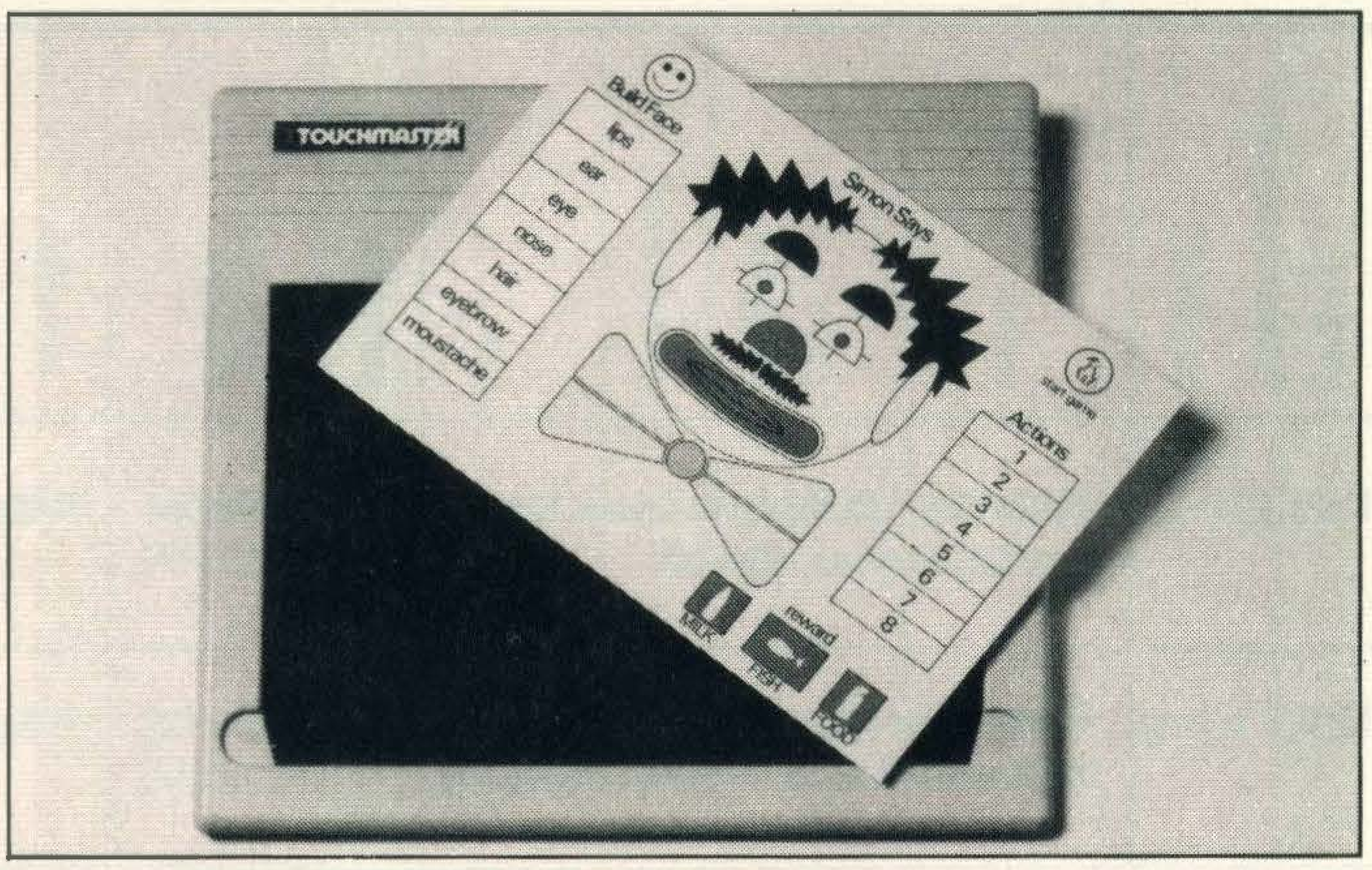
Touchmaster, a touch sensitive pad, can be operated as the name suggests simply by touch.

The pad requires software and a relevant overlay and is operated by touching the pad in the appropriate places.

At present, **Touchmaster,** the manufacturer, has a graphics package for the MSX compatible pad, but Multisound Synthesiser, Touch Chess and a Programmer's Toolkit are in development.

Touchmaster plans to launch the touch pad later in the year for £149.99 together with an MSX interface which will cost about £16.

Touchmaster Ltd — (0656) 744770.



Accessory touch pad from Touchmaster

KEYBOARDS

Only two keyboards will be available for the MSX computers by the end of the year.

Yamaha claims that its keyboard, the DX7, is the first one in the country to use digital synthesisers.

Two ROM cartridges in the keyboard store 128 preprogrammed sounds and these include sounds of most musical instruments as well as special effects.

Other features include six sine wave operators, six envelopes and 16 polyphonic notes.

The DX7 will attach to any synthesiser or MSX computer with a MIDI interface.

Yamaha — (0908) 640202.

By November, **JVC's** new keyboard, the KV 600, will be available for £629.

Preprogrammed sounds include 56 stereo rhythmic variations, 16 percussion instruments and a digital sequencer for 128 notes.

The keyboard covers four octaves and has built in stereo speakers, although the board can be connected to amplifiers. It will also attach to a guitar strumboard (a stringless instrument) which will cost about £40.

The KV 600 keyboard will operate independently as a music synthesiser, but attaches to any MSX computer via a MIDI interface.

JVC — 01-450 2621.

DISC DRIVES

Disc drives are designed to store and run programs filed on these discs.

JVC is planning to release a disc drive in January. Although the price has not been decided on yet, JVC does know that its first model will take single sided double density 3½ inch discs. It will also provide 500K bytes of unformatted memory. A 5½ inch disc version is also planned.

JVC — 01-504 2621.

The Quick diskdrive, **Mitsumi's** new drive, is already on sale in Japan and will probably be released in this country by the end of the year for about £100.

The disk drive holds about 128K bytes of unformatted memory and uses single sided double density 2.8 inch disks.

No distributor announced.

The **Sony** disk drive is already on sale and retails at £349.99.

It uses 3½ inch single sided double density disks and has 500K bytes of unformatted memory.

Sony — (0784) 61688.

Spectravideo's SV1- 707 MSX disk drive provides 500K bytes of unformatted memory and has a built in disk drive controller.

The drive retails at £345.

Spectravideo — 01-3300101.

SPEECH SYNTHESISERS

Strange robotic speech similar to that of a strangled Dalek can be created with speech synthesisers. Most use the allophone system and **Kuma's** package is no exception.

The package, which costs £69.50, consists of a program on cassette and a card which plugs into the computer's RAM slot.

Kuma Computers — (07357) 4335.

Model	Number of Fire Buttons	Firing Directions	Fast Fire	Feet	Length of Cord	Price	Supplier
Atari CX-40	1	8way	Yes	Rubber feet	100cm	£7.99	Atari International (0753) 33344
Atari CX-24	2	8way	Yes	None	100cm	£9.99	Atari International (0753) 33344
Trak-Ball CX-80	n/a	Infinite	Yes	Rubber feet	100cm	£19.99	Atari International (0753) 33344
Paddles CX-3004	2	n/a	Yes	n/a	100cm	£9.99	Atari International (0753) 33344
VJ 200	2	8way	No	Suction cups	150cm	£15	Canon (UK) Ltd 01-773 3173
The Boss	1	8way	No	None	100cm	£17.95	CGL 01-508 5600
Wico Red Ball	2	8way	Yes	Rubber feet	150cm	£19.95	CGL 01-508 5600
Wico 3 way Deluxe (handles)	2	8way	No	Sticky feet	150cm	£22.95	CGL 01-508 5600
Wico Trak-Ball	2	Infinite	No	Rubber feet	150cm	£34.95	CGL 01-508 5600
Starfighter	1	8way	No	None	150cm	£10.95	Consumer Electronics 061-682 2339
Slik stik	1	8way	No	Rubber feet	150cm	£8.95	Consumer Electronics 061-682 2339
Tac-2	2	Infinite	No	Rubber feet	180cm	£15.95	Consumer Electronics 061-682 2339
Joy Sensor	Touch sensitive pad	Infinite	Yes	No	180cm	£19.95	Consumer Electronics 061-682 2339
Triga Command	1	8way	No	Rubber feet	150cm	£12.95	Datel Electronics 0782 273815
Super Champ	2	12way	Yes	Suction cups	300cm	£12.95	Dean Electronics 0344 885661
Zircon Video Command	2	8way	No	Suction cups	100cm	£11.75	Males 0455 610770
JVC HCJ615	2	8way	No	Suction cups	150cm	£12.95	JVC 01-450 2621
Competition Pro 1000	1	8way	No	Rubber feet	150cm	£8.95	Kempston Micro Electronics (0234) 856633
Competition Pro 3000	3	8way	No	Rubber feet	150cm	£12.75	Kempston Micro Electronics (0234) 856633
Competition Pro 5000	2	8way	No	Rubber feet	150cm	£13.50	Kempston Micro Electronics (0234) 856633

Model	Number of Fire Buttons	Firing Directions	Fast Fire	Feet	Length of Cord	Price	Supplier
Junior Pro	1	8way	No	Rubber feet	150cm	£5.99	Kempston Micro Electronics (0234) 856633
Lightning Deluxe	1	8way	No	None	150cm	£7.50	Lightning 01-969 5255
Hyposhot for track and field	2	8way	No	Rubber feet	100cm	£15.99	Micro-Peripherals (0256) 473232
Delta 35c	3	Infinite	Yes	Hand held	130cm	£9.95	Voltmace Ltd (0462) 894410
Quickshot 1	2	8way	No	Rubber feet	120cm	£9.95	Vulcan Electronics 01-203 6366
Quickshot 2	2	8way	No	Rubber feet	150cm	£11.95	Vulcan Electronics 01-203 6366
Sanyo NJ002	2	8way	No	Suction cups	150cm	£12.95	Sanyo Marubeni (0923) 46363
Arcade	1	8way	No	None	150cm	£15.45	Silica Shop 01-309 1111
The Kraft	1	8way	no	Hand held	200cm	£9.95	Silica Shop 01-309 1111
Kraft Switch hitter	2	8way	Yes	Rubber feet	150cm	£14.95	Silica Shop 01-309 1111
Le Stik	1	Infinite	No	No Base Stick with Mercury tilt switches	150cm	£19.95	Silica Shop 01-309 1111
Pointmaster	1	8way	No	Rubber feet	150cm	£14.65	Silica Shop 01-309 1111
Pointmaster Pro	1	8way	Yes	Suction cups	50cm	£14.95	Silica Shop 01-309 1111
TG Enjoystick	2	8way	Yes	Suction cups	100cm	£27.95	Silica Shop 01-309 1111
TG Trak-Ball	1	Infinite	Yes	Rubber feet	200cm	£49.95	Silica Shop 01-309 1111
Sony JS-55	2	8way	Yes	No	150cm	£19.95	Sony 01-799 9811
Sony JS-75	3	8way	Yes	None	Remote control	£64.95	Sony 01-799 9811
SV01MSX	2	8way	No	Suction cups	150cm	£11.95	Spectra-video 01-330 0101
Spectravideo Quickshot	2	8way	No	Suction cups	100cm	£13.45	Spectra-video 01-330 0101
Spectravideo Quickshot 2	2	8way	Yes	Rubber feet	200cm	£11.95	Spectra-video 01-330 0101
Pro-Ace Competition	2	8way	No	None	150cm	£12.95	Sumlock Electronics 061-834 4233
Toshiba HX-J400	2	Infinite	No	None	150cm	£12.95	Toshiba (UK) Ltd (0276) 62222

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- YAMAHA DIGITAL FM VOICE GENERATOR – With 46 built in voices. Plus your own.

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- **YRM102 FM Voicing Program** – For precise control over the CX5M digital FM Voice Generator, to edit and alter pre-programmed voices or create new voices of your own.
- **YRM103 DX7 Voicing Program** – For DX7 owner's.Displays all DX7 voice parameters. Therefore, programming is direct from the CX5M Computer Keyboard.
- **YRM104 Music Macro** – For incorporating top-quality musical voices into BASIC computer programmes.

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Colour monitors have been designed specifically for computers. Computer generated characters and graphics can be displayed clearly in high resolution and an added bonus is that eye strain is reduced.

Resolution refers to the number of pixels (computer defined dots) in the horizontal and vertical direction. A high resolution is equal to about 920 × 300 pixels whereas a lower resolution is about 370 × 470 pixels.

There are two main ways of sending a monitor signal. With RGB (red, green and blue), the three colours are sent as three separate signals.

Composite video or PAL signals are sent with the three main colours already synchronised.

Band widths indicate the frequency range of signals to which a monitor can respond.

Cathode Ray Tubes (CRT) are the tubes used by the monitors and are usually measured in inches.

The size refers to the picture diagonal.

Display refers to the number of characters which can be comfortably displayed.

Model	Resolution	Video Band Width	C.R.T.	Display	Input	Built In Speaker	Green Screen	Brightness Contrast	Horizontal Vertical	Supplier	Price
Commodore 1701	High	15MHz	14in	40 × 25	PAL	Yes	No	Yes	No	Commodore (0536) 205555	£265
Cub 1431 AP/MS	Standard	18MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	No	Microvitec (0274) 390011	£258
Cub 1451MP/MS4	Medium	18MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	No	Microvitec	£391
Cub 2030CS5	Standard	18MHz	20in	80 × 25	RGB/PAL	Yes	No	Yes	No	Microvitec	£443
Fidelity CM14	Medium	12MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	No	Fidelity TLC 01-9658771	£199
Fidelity CTM1400	Medium	12MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	No	Fidelity	£210
Grundig P40125	Medium	10MHz	35.6cm	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Grundig International 01-6592468	£220
Grundig P40145	Medium	10MHz	35.6cm	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Grundig	£260
Grundig C2402	Standard	10MHz	14in	80 × 25	RGB	Yes	No	No	No	Newark Video Centre (0636) 71475	£287
Grundig C3104	Standard	10MHz	16in	80 × 25	RGB	Yes	No	No	No	Newark	£299
Grundig C3404	Standard	10MHz	16in	80 × 25	RGB/PAL	Yes	No	Yes	No	Newark	£344
Grundig C60100	Standard	10MHz	20in	80 × 25	RGB	Yes	No	Yes	No	Newark	£339
Grundig P55145	Medium	10MHz	50.8cm	80 × 25	RGB	Yes	No	Yes	Yes	Grundig	£360
Grundig C64100	Standard	10MHz	20in	80 × 25	RGB/PAL	Yes	No	Yes	No	Newark	£378
Grundig C70100	Standard	10MHz	22in	80 × 25	RGB	Yes	No	Yes	No	Newark	£378
Grundig C74100	Standard	10MHz	22in	80 × 25	RGB/PAL	Yes	No	Yes	No	Newark	£418
Grundig C84100	Standard	10MHz	26in	80 × 25	RGB/PAL	Yes	No	Yes	No	Newark	£546
ITT CD3125NB	Normal	18MHz	14in	40 × 25	RGB	No	No	Yes	Yes	Sanyo Marubeni (UK) Ltd (0923) 46363	£229
ITT RL2301/1	Low	4MHz	14in	70 × 25	RGB	Yes	No	Yes	No	ITT Consumer Products (0268)3040	£306
ITT RL2315	Low	4MHz	14in	70 × 25	RGB	Yes	No	Yes	No	ITT	£335
ITT RL2310/M	Low	4MHz	14in	70 × 25	RGB/PAL	Yes	No	Yes	No	ITT	£35
JVC TM-90 PSN	Medium	10MHz	10in	40 × 25	RGB/PAL	Yes	No	Yes	Yes	JVC 01-4502621	£518
Kaga K12RX	Medium	15MHz	12in	80 × 25	RGB/PAL	Yes	Yes	Yes	Yes	Data Efficiency (0442) 60155	£247
Kaga KR12R2	High	15MHz	12in	80 × 25	RGB	No	Yes	Yes	Yes	Data Efficiency	£343
Kaga KR12R3	Very High	18MHz	12in	80 × 25	RGB	No	Yes	Yes	Yes	Data Efficiency	£475
Luxor HR14	High	25MHz	14in	85 × 25	RGB	No	No	Yes	No	Emco Electronics 01-7370971	£516
Nordmende 1534	Low	3MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Nordmende	£230
Nordmende 3534	Low	3MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Nordmende (0296) 20501	£260
Nordmende 3510	Low	3MHz	14in	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Nordmende	£300
Philips 2007	Normal	20MHz	40in	64 characters × 25 lines	RGB/PAL	Yes	No	Yes	No	Philips 01-6892166	£263
Phoenix FTC1203R	High	20MHz	12in	80 × 25	RGB	No	No	Yes	Yes	Emco Electronics	£459
Portabel 5134	Standard	5MHz	20in	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Portatel	£322
Portatel Luxor	Standard	5MHz	16in	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Portatel (76) 88972	£344
Portatel 5634	Standard	5MHz	22in	80 × 25	RGB/PAL	Yes	No	Yes	Yes	Portatel	£357
Portatel 6734	Standard	5MHz	26in	80 × 25	RGB/PAL	Yes	No	Yes	No	Portatel	£403
Sabre	Medium	18MHz	14in	80 × 25	RGB	No	No	Yes	No	Cotron Electronics (0203) 21247	£523
Profeel KX20PSI	Standard	3MHz	20in	40 × 25	RGB/PAL	No	No	Yes	Yes	Sony 01-7999811	£500
Sanyo CD3195B	Medium	18MHz	14in	40 × 25	PAL	Yes	Yes	Yes	Yes	Sanyo	£229
Sanyo CD3117NB	Medium	18MHz	14in	60 × 25	RGB	No	No	Yes	Yes	Sanyo	£401
Sanyo CD115HB	High	18MHz	14in	80 × 25	RGB	No	No	Yes	Yes	Sanyo	£574

BUYERS GUIDE

KEY

Type: M — Dot matrix printer. The image is printed by the impact of pins from a pin matrix, the particular pins determining the shape of the character. Dot matrix printers are very fast.

D — Daisywheel printer. These printers work rather like electronic typewriters, using a daisywheel of formed characters. Quality is high, but speeds are slower and you are limited to the characters on the daisywheel.

T — Thermal printer. The print head is heated, thus transferring ink to paper, using a matrix of needles. These printers run very quietly.

I — Inkjet printer. Squirts of ink are directed at the paper to form the characters. It is all relatively new and pricey.

Matrix size: Applicable only to dot matrix and thermal printers — the number of pins used to form a character. Maximum figures are given, the more, the better the quality.

Maximum speed: The number of characters per second (cps) that can be printed.

Paper width: The maximum width of paper the printer will take.

Paper feed: T — Tractor feed. Continuous paper, perforated at the edges, is used and width is adjustable.

P — Pinfeed. As tractor feed, but paper width is fixed.

F — Friction feed. The sort of feed found on typewriters, for one sheet of paper at a time.

Graphics: B — Block graphics. Prints using set characters provided by the printer.

H — Hi-res graphics. The printer can print anything that appears on the screen, in text or graphics modes.

Interface: C — Centronics. The printer interface found on MSX computers.

R — RS232C. An alternative printer interface that can be added to MSX computers.

Other: D — the printer will print the lower portion of characters that extend below the line (g, j etc.)

M — the printer has a slower printing speed to give near letter quality printing.

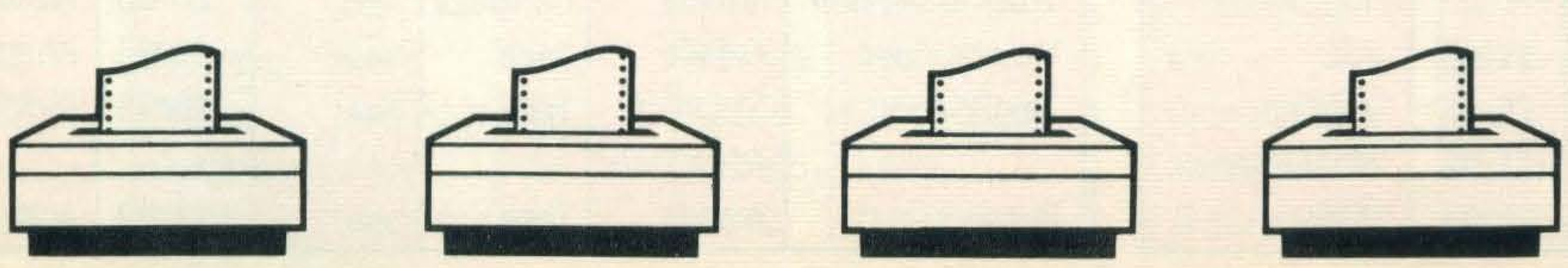
B — the printer is battery powered.

C — the printer prints in more than one colour.

K — the printer has a

Model	Type	Matrix Size	Max Speed	Paper Widths	Paper Feed	Graphics	Interface	Other	Price	Supplier
ACT Writer 10	M	9 × 7	120cps	10	T F	H	C	D	£454	ACT
ACT Writer 12	M	9 × 7	163cps	—	T F	H	C	D	£799	ACT
Brother HR5	M	9 × 9	30cps	8	F	H	C R	B,D	£181	Brother
Brother EP44	M	24 × 18	16cps	8	F	—	R	K,B	£261	Brother
Brother EP120	M	12 × 18	120cps	10	T F	H	C R	M,D	£305	Brother
Brother HR15	D	—	13cps	13.5	F	—	C R	—	£512	Brother
Canon PW1080A	M	11 × 9	160cps	10	T F	H	C	D	£367	Canon
Canon PW1156A	M	11 × 9	160cps	17	T F	H	C	D	£459	Canon
Canon PJ1080A	I	7 × 9	37cps	8.5	F	H	C	C	£498	Canon
Centronics Horizon 80	M	11 × 9	160cps	12	T F	H	C	D,M	£575	Centronics
Centronics Horizon 156	M	11 × 9	160cps	16.5	T F	H	C	D,M	£748	Centronics
Centronics GLP	M	11 × 9	50cps	12	T F	H	C	M,D	£230	Centr.
Citizen 510	M	5 × 7	45cps	3	F	B	C R	—	£205	Datac
C. Itoh 7500	M	9 × 9	105cps	11	T F	B	C	—	£403	C. Itoh
C. Itoh Y10	D	NA	20cps	11	F	B	C	D	£403	C. Itoh
C. Itoh 8510S	M	9 × 9	180cps	11	T F	H	C R	D	£518	C. Itoh
C. Itoh 8510SC	M	9 × 9	180cps	11	T F	H	C R	D,C	£633	C. Itoh
C. Itoh 1550S	M	9 × 9	180cps	15	T F	H	C R	D	£748	C. Itoh
C. Itoh 1550SC	M	9 × 9	180cps	15	T F	H	C R	D,C	£863	C. Itoh
Colourjet 132	I	5 × 8	40cps	8	F	H	C	C,D	£633	Integrex
Daisystep 2000	D	NA	20cps	13	F	—	C		£263	Micro P.
Dyneer 12	D	NA	12cps	11.5	F	—	C	D	£316	X-Data
Dyneer DW16	D	NA	16cps	16	F	—	C R	D	£378	X-Data
Dyneer DW20	D	NA	20cps	13	F	—	C R	D	£615	X-Data
Epson P-40	T	7 × 9	45cps	4	F	H	C	D,B	£100	Epson
Epson RX-80	M	9 × 9	100cps	10	T	H	C	D	£286	Epson
Epson RX-80/FT	M	9 × 9	100cps	10	T F	H	C	D	£328	Epson
Epson FX-80	M	9 × 9	160cps	10	T	H	C	D	£503	Epson
Epson DX100	D	NA	13cps	11	F	—	C R		£546	Epson
Epson MX-100	M	9 × 9	100cps	16	T	H	C	D	£546	Epson
Epson FX-100	M	9 × 9	80cps	16	T	H	C	D	£654	Epson
Getex D14	D	NA	13cps	13.5	F	—	C R	—	£535	Geveke
Getex S11 CQ	M	9 × 7	100cps	—	T F	H	C R	D	£546	Geveke
Getex S31 CQ	M	9 × 7	100cps	15.5	T F	H	C R	D	£725	Geveke
Honeywell L11-I	M	9 × 9	80cps	—	T F	H	C	D	£401	Geveke
Honeywell S11-CQ	M	16 × 35	100cps	—	T F	H	R	M,D	£516	Geveke
Juki G100	D	—	18cps	15.5	F	—	C	—	£299	Micro P.
Juki G300	D	—	40cps	15.5	F	—	C		£689	Micro P.
KDC FT5001	M	9 × 9	100cps	10	T F	H	C	D	£332	Hal
KDC WP550	D	—	14cps	—	T F	—	C R		£459	Hal
Mannesman Tally 80	M	9 × 7	80cps	10	T F	B	C R	D	£250	Mannesman Tally
Mannesman Tally 160	M	9 × 7	160cps	10	T F	B	C R	D	£631	Mannesman Tally
Mitsui 2200	M	9X9	180cps	10	F	H	C	D	£516	Thame
Mitsui 4200	M	9X9	180cps	15	F	H	C	D	£643	Thame
MP 165	M	17 × 17	160cps	—	T F	H	R	M,D	£378	Micro P.
NEC PC 8023	D	9 × 7	120cps	9	TPF	H	C	D	£229	NEC
NEC Pinwriter P2	M	7 × 9	180cps	10	T F	H	C R	D,M	£747	NEC
OKI Microline 80	M	7 × 9	80cps	9.5	P F	B	C R	—	£229	X-Data
OKI Microline 82A	M	9 × 9	120cps	9.5	P F	B	C R	D	£344	X-Data
OKI Microline 92	M	9 × 9	160cps	9.5	P F	H	C R	D,M	£493	X-Data
OKI Microline 830	M	9 × 9	120cps	15.5	T F	B	C R	D	£562	X-Data
OKI Microline 93	M	9 × 9	160cps	15.5	T F	H	C	D,M	£673	X-Data
Olivetti DM5060	M	9 × 7	120cps	—	F	H	C	D	£459	Olivetti
Olivetti DM4100	M	9 × 7	120cps	—	T F	H	C	D	£666	Olivetti
Olympia Compact	D	NA	14cps	13.5	T F	—	C R		£459	Intelligent
Olympia ESW 102	D	NA	17cps	17	F	—	C R	—	£650	Intelligent
Panther DX109	M	9 × 9	96cps	10	T F	H	C	D	£229	Datac
Panther II DX120	M	9 × 9	120cps	10	T F	H	C	D,M	£367	Datac
Paper Tiger 8010	M	36 × 18	180cps	9	T F	H	C R	D,M	£512	Data-prod
Model	Type	Matrix Size	Max Speed	Paper Widths	Paper Feed	Graphics	Interface	Other	Price	Supplier

Model	Type	Matrix Size	Max Speed	Paper Widths	Paper Feed	Graphics	Interface	Other	Price	Supplier
Paper Tiger 8020	M	36 × 18	180cps	14	TF	H	CR	D,M	£674	Data-prod
Qume Letter Pro 20	D	NA	20cps	13	F	—	R	—	£684	Qume
Remstar 201	D	NA	13.3cps	13.5	F	—	CR	K,D	£454	PMS
Seikosha GP-50A	M	5 × 8	40cps	5	F	H	C	—	£100	DRG
Seikosha GP-500A	M	5 × 7	50cps	10	T	—	CR	—	£180	DRG
Seikosha 100A	M	5 × 7	50cps	10	T	—	CR	—	£169	DRG
Seikosha GP-550A	M	9 × 8	50cps	10	PF	H	C	M,D	£230	DRG
Seikosha GP-250X	M	5 × 7	50cps	10	PF	H	CR	D	£270	DRG
Seikosha 700A	M	5 × 8	50cps	10	PF	H	CR	C	£350	DRG
Shinwa CP80	M	13 × 9	80cps	10	TF	H	C	D	£206	Micro P.
Shinwa CPA80	M	13 × 9	100cps	10	TF	B	C	D	£229	Micro P.
Silver Reed EXP400	D	NA	12cps	12	F	—	CR	D	£288	Silver Reed
Silver Reed EXP500	D	NA	16cps	13	F	—	CR	D	£344	Silver Reed
Silver Reed EXP550	D	NA	19cps	17	F	—	CR	D	£518	Silver Reed
Smith Corona Fastext 80	M	9 × 8	80cps	11	TF	H	C	D	£224	Smith-Corona
Smith Corona TP1	D	NA	11cps	13	F	—	R	D	£250	Smith Corona
Smith Corona D100	M	9 × 8	120cps	11	TF	H	C	D	£286	Smith Corona
Smith Corona L1000	D	NA	12cps	13	F	—	CR	D	£299	Smith Corona
Smith Corona D200	M	17 × 18	160cps	11	TF	H	CR	M,D	£483	Smith Corona
Smith Corona EC1300	D	NA	14cps	14	F	—	CR	D, K	£569	Smith Corona
Smith Corona D300	M	17 × 18	160cps	15	TF	H	CR	M, D	£633	Smith Corona
Star STX-80	T	9 × 10	60cps	10	F	8	C	D	£160	Star
Star Gemini 10	M	9 × 9	120cps	10	F	8 H	C	D	£286	Star
Star Gemini 15	M	9 × 9	120cps	15	F	B	C	D	£401	Star
Star Power type	D	NA	18cps	10	F	—	C	D	£431	Star
Star Delta 10	M	9 × 11	160cps	10	TF	B	CR	D	£505	Star
Star Delta 15	M	9 × 11	160cps	15	TF	B	CR	D	£569	Star
Star Radix 10	M	9 × 11	200cps	10	TF	B	CR	M, D	£612	Star
Star Radix 15	M	9 × 11	200cps	15	TF	B	CR	M, D	£719	Star
Taxan KP-810	M	9 × 9	140cps	10	TF	H	CR	D	£345	Data E.
Taxan KP-910	M	9 × 9	140cps	17	TF	H	C	D	£459	Data E.
Toshiba HX-P570	Pens	NA	—cps	12	F	H	C	C, D	£250	Toshiba
Toshiba HX-P550	M	—	105cps	16	F	H	C	D	£350	Toshiba
Toptronic 15	D	—	13.3	13.5	F	—	CR	K, D	£431	PMS
Triumph Adler TRD 7020	D	NA	20cps	14	F	—	CR	D	£431	Triumph Adler
Triumph Adler DRH 80/1	M	7 × 9	80cps	12	TF	H	CR	D	£569	Triumph Adler
Triumph Adler DRH 136	M	7 × 9	120cps	—	TF	H	CR	D, M	£621	Triumph Adler
Triumph Adler DRH	M	7 × 9	80cps	15	TF	H	CR	D	£661	Triumph Adler
Turbo 20	D	NA	20cps	15	F	—	C	—	£450	OEM
VRX80	M	7 × 9	100cps	9.5	T	H	CR	D	£489	Integrex
Model	Type	Matrix Size	Max Speed	Paper Widths	Paper Feed	Graphics	Interface	Other	Price	Supplier



keyboard, so can be used as a typewriter.

F — the printer can be used as a viewdata terminal.

ADDRESS

ACT—(021) 501 2284

Brother Office Equipment—061-330 6531

Canon (UK) Ltd—01-773 3173

Centronics—01-581 1011

C. Itoh Electronics Co. Ltd—01-9464960

Datac Ltd—061-9412361

Data Efficiency—(0442) 60155

Dataproducts (Retail Division) Ltd.—(0784) 38733

DRG Business Machines—(0934) 419914

Epson—01-9028892

Euro Pacific Computers (Int) Ltd.—(0245) 26590

Geveke Electronics—(04867) 88676

Hal Computers—(0252) 517171

Integrex Ltd.—(0283) 215432

Intelligent Interfaces—(0789) 296879

Mannesman Tally Ltd.—(0734) 788711

Microntel—(0273) 205099

Micro Peripherals—(0256) 473232

NEC—01-267 7000

Newbury Data—(0784) 61500

OEM Peripherals—01-748 8404

Olivetti Peripheral Equipment—01-7856666

PMS Developments—(0432) 265768

Qume (UK) Ltd.—(0734) 584646

Silver Reed (UK) Ltd.—(0923) 45976

Smith Corona Data Products—01-900 1222

Star Computers Peripherals—(0734) 752273

Thame Systems—(084) 421 6698

Toshiba (UK) Ltd—(0276) 62222

Triumph Adler—01-2535608

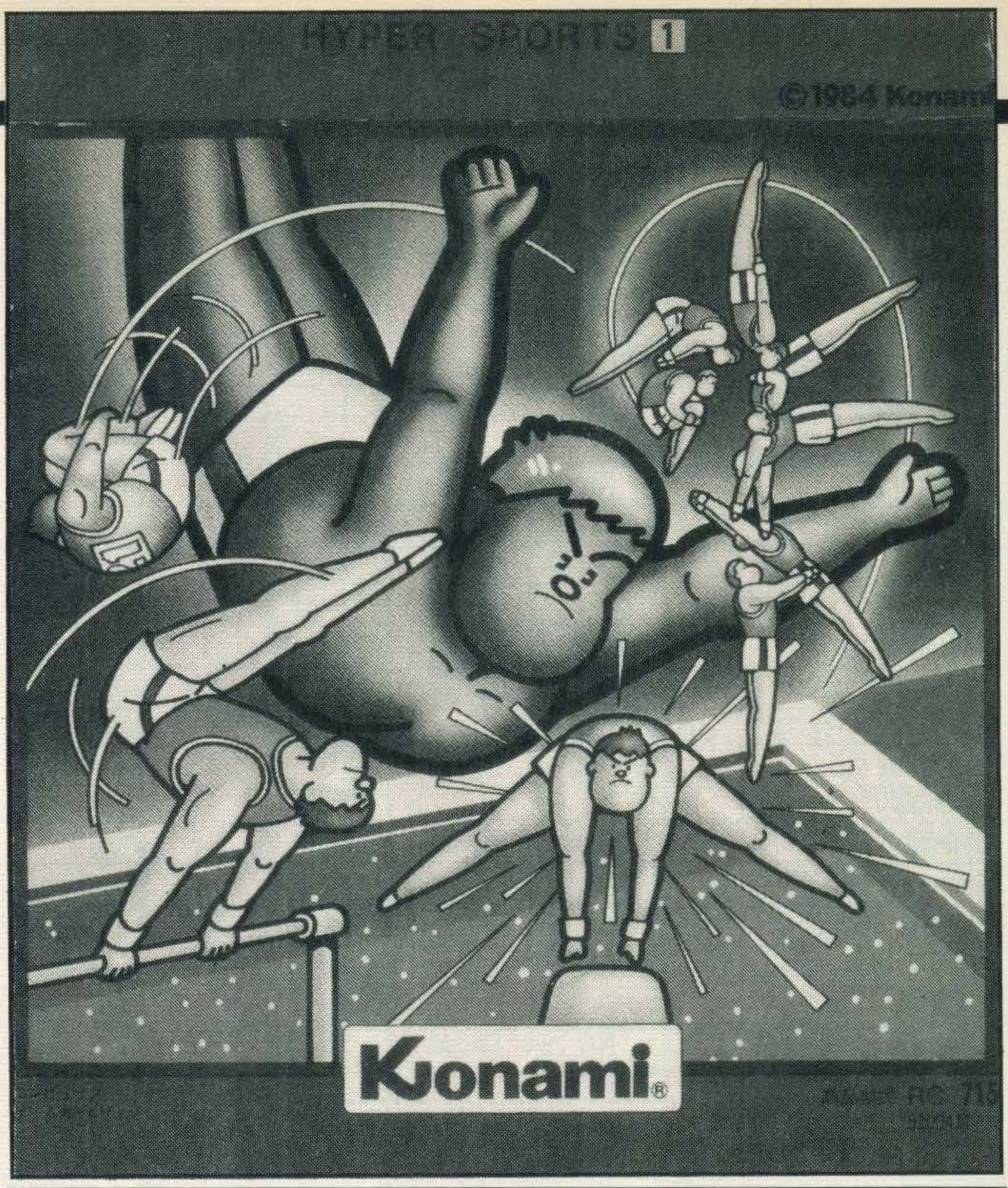
WBM Business Supplies Ltd.—(04862) 66444

X-Data—(0753) 72331

BUYERS GUIDE

GAMES AND SIMULATORS

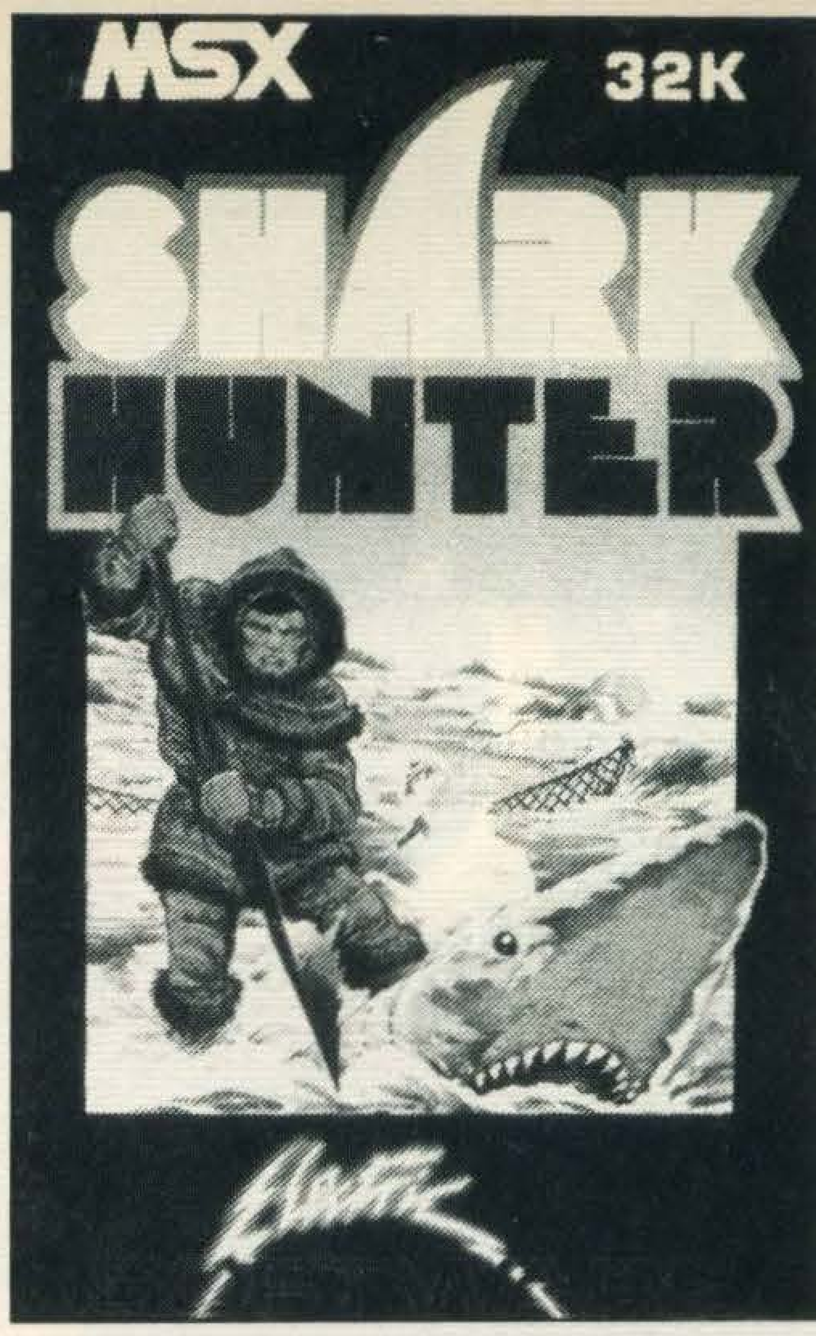
Title	Type	Format	Joystick	Price	Supplier
3DGolf	Arcade	Tape	No	£7·95	Toshiba
737 Flight Simulator	Simulator	Tape	Yes	£9·95	Mirrorsoft
Adventure Plus	Adventure	Tape	No	£0·00	Premier
Antarctic Adventure	Arcade	Cartridge	Yes	£0·00	Konami
Ant Attack	Arcade	Tape	Yes	£7·95	Quicksilva
Anty	Arcade	Tape	Yes	£6·95	MPL
Armoured Assault	Arcade	Tape	Yes	£6·95	Spectravideo
Athletic Land	Arcade	Cartridge	Yes	£0·00	Konami
Battleship Clapton II	Arcade	Tape	Yes	£7·95	Toshiba
Bazam	Arcade	Tape	Yes	£0·00	Hewson
Beamrider	Arcade	Tape	Yes	£11·99	Activision
Binary Land	Arcade	Tape	No	£8·95	Kuma
Blagger	Arcade	Tape	Yes	£7·95	Alligata
BMX Racers	Arcade	Tape	Yes	£1·99	Mastertronic
Boogaboo (The Flea)	Arcade	Tape	Yes	£7·95	Quicksilva
Bridge	Traditional	Tape	No	£9·95	Alligata
Bridge Professor	Traditional	Cartridge	No	£0·00	??
Buzz Off	Arcade	Tape	Yes	£8·95	Electric
Cannon Fighter	Arcade	Tape	Yes	£6·95	MPL
Cave Adventure	Adventure	Tape	No	£5·95	Knights
Chess Professor	Traditional	Cartridge	No	£0·00	??
Chuckie Egg	Arcade	Tape	Yes	£0·00	A&F
Circus Charlie	Arcade	Cartridge	Yes	£0·00	Konami
Coco and the Castle	Adventure	Tape	Yes	£6·95	Kuma
Comic Bakery	Arcade	Cartridge	Yes	£0·00	Konami
Crazy Golf	Arcade	Tape	Yes	£6·95	Mr Micro
Cribbage	Traditional	Tape	No	£5·95	Kuma
Cribbage	Traditional	Tape	No	£0·00	Premier
Cubit	Strategy	Tape	Yes	£6·95	Mr Micro
Daredevil Deris	Arcade	Tape	Yes	£7·95	Visions
Decathalon	Arcade	Tape	Yes	£11·99	Activision
Disc Warrior	Arcade	Tape	Yes	£7·95	Alligata
Dog Fighter	Arcade	Tape	No	£6·95	Kuma
Driller Tanks	Arcade	Tape	No	£8·95	Kuma
Eric and the Floaters	Arcade	Tape	Yes	£5·95	Kuma
Exploding Atoms	Strategy	Tape	No	£5·95	Knights
Fire Rescue	Arcade	Tape	No	£7·95	Kuma
Flightpath 77	Simulator	Tape	Yes	£6·95	Anirog
Flipper Slipper	Arcade	Tape	Yes	£6·95	Spectravideo
Frantic Freddy	Arcade	Tape	Yes	£6·95	Spectravideo
Fred	Arcade	Tape	Yes	£7·95	Quicksilva
Glug Glug	Arcade	Tape	Yes	£0·00	CRL
Grid Runner	Arcade	Tape	Yes	£5·00	Llamasoft
Holdfast	Simulation	Tape	No	£5·95	Kuma
Hot Shoe	Strategy	Tape	Yes	£5·95	Longman
Humphrey	Arcade	Tape	Yes	£6·95	Mr Micro
Hustler	Traditional	Tape	Yes	£6·99	Bubble Bus
Hyper Sports	Arcade	Cartridge	Yes	£0·00	Konami
Hyper Viper	Arcade	Tape	No	£7·95	Kuma
Lazy Jones	Arcade/ Adventure	Tape	Yes	£0·00	Terminal
Les Flics	Arcade			£7·95	PSS
Knight Othello	Traditional			£5·95	Knights
Magic Carpet	Arcade			£1·99	Mastertronic
Maxima	Arcade			£7·95	PSS



EDUCATIONAL

Title	Type	Format	Joystick	Price	Supplier
Mind Control	Arcade	Tape	Yes	£1·99	Mastertronic
Mr Wong's Loopy Laundry	Arcade	Tape	Yes	£6·95	Artic
Oh Mummy!	Strategy	Tape	Yes	£5·95	Longman
Omega Run	Simulator	Tape	Yes	£0·00	CRL
Panic Junction	Arcade	Tape	Yes	£6·95	MPL
Pinball	Arcade	Tape	No	£7·95	Toshiba
Pitfall II	Graphic Adventure	Tape	Yes	£11·99	Activision
Polar Star	Arcade	Tape	Yes	£7·95	Toshiba
Punchy	Arcade	Tape	Yes	£6·95	Mr Micro
Pyramid Warp	Arcade	Tape	Yes	£7·95	Toshiba
River Raid	Arcade	Tape	Yes	£11·99	Activision
Sector Alpha	Arcade	Tape	Yes	£6·95	Spectravideo
Shark Hunter	Arcade	Tape	Yes	£9·95	Electric
Smash Out	Arcade	Tape	Yes	£5·95	Knights
Snooker	Arcade	Tape	Yes	£8·95	Visions
Sorcery	Arcade	Tape	Yes	£7·95	Virgin
Space Shuttle	Simulation	Tape	Yes	£11·99	Activision
Space Walk	Arcade	Tape	Yes	£1·99	Mastertronic
Special Operations	Adventure	Tape	No	£6·95	M.C. Lothlorten
Spectron	Arcade	Tape	Yes	£6·95	Spectravideo
Spooks and Ladders	Arcade	Tape	No	£6·95	Kuma
Super Cobra	Arcade	Cartridge	Yes	£0·00	Konami
Super Cross Force	Arcade	Tape	Yes	£6·95	Spectravideo
Supermaze	Family	Tape	No	£6·95	MPL
Supermind	Family	Tape	No	£6·95	MPL
Superpuzzle	Family	Tape	No	£6·95	MPL
The Snowman	Arcade	Cartridge	No	£7·95	Quicksilva
The Wreck	Arcade	Tape	Yes	£9·95	Electric
Time Bandits	Arcade	Tape	Yes	£6·95	PSS
Time Pilot	Arcade	Cartridge	Yes	£0·00	Konami
Track and Field I	Arcade	Cartridge	Yes	£0·00	Konami
Track and Field II	Arcade	Cartridge	Yes	£0·00	Konami
Vicious Viper	Arcade	Tape	Yes	£5·95	Knights
Zakil Wood	Graphics Adventure	Tape	No	£6·95	Mr Micro
Zenji	Arcade	Tape	Yes	£11·99	Activision

SOFTWARE





Title	Type	Format	Joystick	Price	Supplier
Adder Sums	Maths	Tape	No	£14·95	Ampalsoft
Angles	Maths	Tape	No	£6·95	Spectravideo
BMXNumber Jump	Maths	Tape	Yes	£7·95	Longman
Calculation 1	Maths	Tape	No	£14·95	MPL
Calculation 2	Maths	Tape	No	£14·95	MPL
French is Fun	Language	Tape	No	£7·95	CDS
Fun Sums	Maths	Tape	No	£14·95	Ampalsoft
Fun Words	Reading	Tape	No	£14·95	Ampalsoft
German is Fun	Language	Tape	No	£7·95	CDS
30 Hypermath	Maths	Tape	Yes	£7·95	Longman
Introduction to Basic	Basic	Tape	No	£6·95	Spectravideo
Introduction to Numbers	Maths	Tape	No	£14·95	MPL
Italian is Fun	Language	Tape	No	£7·95	CDS
Junior Maths	Mathematics	Tape	No	£5·95	Knights
MathBug	Maths	Tape	Yes	£6·95	Spectravideo
Memory	—	Tape	No	£14·95	MPL
Monkey Acadamy	Maths	Cartridge	Yes		Konami
Number Painter	Maths	Tape	Yes		ASK
Quzi Safari	General Knowledge	Tape	No	£920	Megacycal
MSX BASIC Tutorial	BASIC	Tape	No	£5.95	Knights
Reasoning	—	Tape	No	£14.95	MPL
Reflexes	—	Tape	No	£14.95	MPL
Revise Computer Studies	Computers	Tape	No	£8.50	Megacycal
Revise Physics	Physics	Tape	No	£8.50	Megacycal
Spanish is fun	Language	Tape	No	£7.95	CDS
Star Words		Tape	Yes	£6.95	Spectravideo
		Cartridge	No		
Subtraction I	Maths	Tape	No	£6.95	Spectravideo
Sum Measure	Maths	Tape	No	£14.95	Ampalsoft
Sum Takeaway	Maths	Tape	No	£14.95	Ampalsoft
Sum Times	Maths	Tape	No	£14.95	Ampalsoft
Sum Weights	Maths	Tape	No	£14.95	Ampalsoft
Teach Yourself Electricity	Physics	Tape	No	£9.20	Megacycal
The Circle I	Maths	Tape	No	£6.95	Spectravideo
The Circle II	Maths	Tape	No	£6.95	Spectravideo
The Sphinx Quiz	General knowledge	Tape	No	£9.20	Megacycal
The Triangle	Maths	Tape	No	£6.95	Spectravideo
Trigonometry—Basic Concepts	Maths	Tape	No	£6.95	Spectravideo
Typing Tutor	Typing	Tape	No	£5.95	Knights
Uni's Learning		Tape	Yes	£6.95	Spectravideo
Factory		Cartridge	No	£6.95	Spectravideo
Word Wobbler	Words	Tape	Yes	£7.95	Longman

FOR BUSINESS

Title	Type	Format	Joystick	Price	Supplier
Cards	Database	Cartridge	No	£49	Computer Mates
Cash Accounts	Financial	Cartridge	No	£99	Computer Mates
Cash book	Financial	Tape	No	£14.95	Micro-Aid
CREDiquote	Retail	Cartridge	No	£100	Office Junior
Database	Database	Tape	No	£19.95	Kuma
Double Entry	Financial	Cartridge	No	£99	Computer

BUSINESS cont.

Title	Type	Format	Joystick	Price	Supplier
Accounts					Mates
Financial Calculator	Financial	Tape	No	£6.95	Spectravideo
Knights Budget Accounts	Financial	Disc	No	£14.95	Knights
Knights Mail List	Mail handling	Tape	No	£14.95	Knights
MARGINator	Financial	Tape	No	£10	Office Junior
Memo-Calc	Database	Tape	No	£14.95	Micro-Aid
PARTsearch	Financial	Tape	No	£100	Office Junior
Payroll	Financial	Cartridge	No	£99	Computer Mates
Payroll	Financial	Tape	No	£29.95	Micro Aid
Spectra Chequebook	Financial	Tape	No	£6.95	Spectravideo
SHOPPAstoppa	Display	Tape	No	£100	Office Junior
Spreadsheet	Financial	Cartridge	No	£49	Computer Mates
Stock Control	Stock	Tape	No	£34.95	Kemp
Tasword MSX	Word processor	Tape	No	£13.90	Tasman
Wdpro	Word processor	Tape	No	£29.95	Kuma
Word Processer	Word Processor	Cartridge	No	£49	Computer Mates
VAT cracker	Financial	Tape	No	£10	Office Junior

UTILITIES

Title	Type	Format	Joystick	Price	Supplier
Champ	Assembler	Tape	No	£12.95	PSS
Games Designer	—	Cartridge	Yes	£9.95	Quicksilva
Hisoft Devpack	Assembler/Dis-assembler	Tape	No	£19.95	Hisoft
Hisoft Pascal	Language	Tape	No	£29.95	Hisoft
Kuma Forth	Language	Tape	No	£39.95	Kuma
Machine Code Language	Assembler	Tape	No	£5.95	Knights
Speech Synthesis	—	Tape	No	£69.50	Kuma
Tasprint MSX	Printer aid	Tape	No	£9.90	Tasman
Zen Assembler	Machine Code	Tape	No	£19.95	Kuma

MISCELLANEOUS

Title	Type	Format	Joystick	Price	Supplier
Address Book	Address	Tape	No	£6.95	Spectravideo
Communications with Viewdata	Communica-tions	Tape	No	£19.95	Kuma
Home Budget	Financial	Tape	No	£14.95	Kuma
MSX Demonstrator	Demonstration	Tape	No	£5.95	Knights
Music Mentor	Music	Tape	Yes	£6.95	Spectravideo
Musiwriter	Musical	Cartridge	No	£19.95	Music Sales

BUYERS GUIDE
SUPPLIERS

These are the names, addresses and telephone numbers of the major MSX software suppliers. Companies who plan MSX involvement but haven't yet released product are not included

A&F Software
Unit 8
Canalside Industrial Estate
Woodbine Street East
Rochdale
Lancs
(0706) 341111

Activision (UK) Inc.
15 Harley House
Marylebone Rd
London NW1
01-486 7588

Alligata Software Ltd
1 Orange Street
Sheffield
S1 4DW
(0742) 755796

Ampalsoft
PO Box 19
Knutsford
Cheshire
WA16 0HE
(0565) 893563

Anirog Software
29 West Hill
Dartford
Kent
(0322) 92513

Artic Computing Ltd
Main Street
Brandesburton
Driffield
Nth. Humberside
Y025 8RL
(0401) 435533

ASK
London House
68 Upper Richmond Road
London
SW15 2RP
01-874 6046

Bubble Bus Software
87 High Street
Tonbridge
Kent
TN9 1RX
(0732) 355962

CDS
Silver House
Silver Street
Doncaster
DN1 1HL
(0302) 21134

Computer Mates
Houghton Down
Stockbridge
Hampshire
(0264) 810824

CRL
9 Kings Yard
Carpenter's Rd
London
E15 2HD
01-533 2918

Electric Software Ltd
8 Green Street
Willingham
Cambridge
CB4 5JA
(0954) 81991

Hewson Consulting Ltd
56B Milton Trading Estate
Milton
Abingdon
Oxon
OX14 4RX
(0235) 832939

Hisoft
180 High Street North
Dunstable
Beds
LU6 1AT
(0582) 696421

Intelligent Software Ltd
37 Bedford Square
London WC1
01-636 7017

Kemp Ltd
43 Muswell Hill
London
N10 3PN
01-444-5499

Knights TV and Computers
108 Rose Mount Place
Aberdeen
AB2 4YW
(0224) 630526

Konami Ltd
269 Field End Road
Eastcote
Middlesex
HA4 9LS
01-429 2446

Kuma Computers Ltd
Unit 12
Horseshoe Park
Horseshoe Road
Pangbourne
Berks RG8 7JW
(07357) 4335

Llamasoft Ltd
49 Mount Pleasant
Tadley
Hants
RG26 6BM
(07356) 4478

Longman Software
Longman House
Burnt Mill
Harlow
Essex
CM20 2JE
(0279) 26721

Mastertronic Ltd
Park Lorne
111 Park Road
London NW8
01-935 4944

M.C. Lothlorien
56A Park Lane
Poynton
Cheshire
SK12 1AE
(0625) 876642

Megacyal Software Ltd
PO Box 6
Birkenhead
Merseyside
LA3 6XH
051-652 3139

Micro Aid
25 Fore Street
Praze
Camborne
Cornwall
TR14 0JX
(0279) 831274

Mirrorsoft
Holborn Circus
London
EC1P 1DQ
01-822 3971

MPL
Maple Walk
Bexhill
East Sussex
TN39 4SN
(04243) 5840

Mr Micro Ltd
69 Partington Lane
Swinton
M27 3AL
061-728 2282

Music Sales
78 Newman St
London W1
01-636 7777

The Office Junior
Market Place
Oundle
Nr Peterborough
PE8 4BA
(0832) 72127

Premier Microsystems
209 Croydon Road
Anerley
London SE20 7YX
01-659 7131

PSS
452 Stoney Stanton Road
Coventry
CV6 5DG
(0203) 667556

Quicksilva Ltd
Palmerston Park House
13 Palmerston Road
Southampton SO1 1LL
(0703) 20169

Spectravideo Ltd
165 Garth Road
Morden
Surrey
SM4 4LH
01-330 0101

Tasman Software Ltd
Springfield House
Hyde Terrace
Leeds
LS2 9LN
(0532) 438301


Terminal Software
Derby House
Derby Street
Bury
BL9 0NW
061-761 4321

Toshiba (UK) Ltd
Toshiba House
Frimley Road
Frimley
Camberley
Surrey
GU16 5JJ
(0276) 62222

Virgin Games
2-4 Vernon Yard
Portobello Road
London W11
01-727 8070

Visions
1 Felgate Mews
Studland Street
London
W6 9JT
01-748 7478


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